MITSUBISHI ELECTRIC
**Changes for the Better**

for a greener tomorrow
eco Changes

INVERTER
Model
# FR-F800

800 series

Enhanced Next-Generation Energy-Saving Inverter
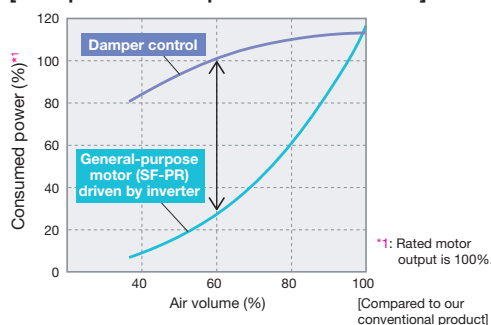
F800

F800

MITSUBISHI ELECTRIC

# 1 ENERGY SAVING

## ❶ Energy Saving with Inverters

The consumed power of a variable-torque load, such as fans, pumps, and blowers, is proportional to the cube of its rotation speed.
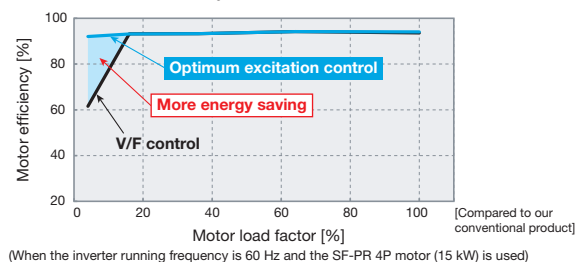Adjusting the air volume by the inverter rotation speed control can lead to energy savings.

**[Example of blower operation characteristic]**

Consumed power (%)[*1]

- Damper control
- General-purpose motor (SF-PR) driven by inverter

Air volume (%)

*1: Rated motor output is 100%.

[Compared to our conventional product]

### Utilizing the motor capability to the full

#### Optimum excitation control

- Optimum excitation control continuously adjusts the excitation current to an optimum level to provide the highest motor efficiency. With a small load torque, a substantial energy saving can be achieved. For example, at 4% motor load torque for a general-purpose motor, the motor efficiency under Optimum excitation control is about 30% higher than the motor efficiency under V/F control.

Motor efficiency [%]

- Optimum excitation control
- More energy saving
- V/F control

Motor load factor [%]

[Compared to our conventional product]

(When the inverter running frequency is 60 Hz and the SF-PR 4P motor (15 kW) is used)

### NEW Improving starting torque and saving energy at the same time

#### Advanced optimum excitation control

Advanced optimum excitation control, which has been newly developed, provides a large starting torque while maintaining the motor efficiency under the conventional Optimum excitation control.
Without the need of troublesome adjustment of parameters (acceleration/deceleration time, torque boost, etc.), acceleration is done in a short time. Also, energy saving operation with the utmost improved motor efficiency is performed during constant-speed operation.
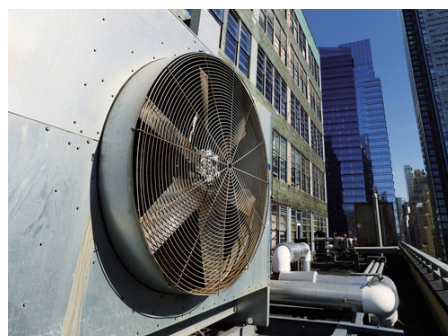
### NEW Supporting operations of various motors

#### Offline auto tuning

The offline auto tuning function to measure circuit constants of the motor enables optimal operation of motors even when motor constants vary, when a motor of other manufacturers is used, or when the wiring distance is long. As well as Mitsubishi general-purpose motors, Mitsubishi PM motors (MM-EFS, MM-THE4), sensorless operation can be performed for other manufacturers' general-purpose motors[*2] and other manufacturers' permanent magnet (PM) motors[*2].
The tuning function enables the Advanced optimum excitation control of other manufacturers' general-purpose motors[*2], which increases the use in the energy saving applications.

Mitsubishi general-purpose (induction) motor SF-PR

General-purpose motor by other manufacturers

PM

Mitsubishi IPM motor MM-EFS

IM

PM motor by other manufacturers

*2: Depending on the motor characteristics, tuning may not be available.
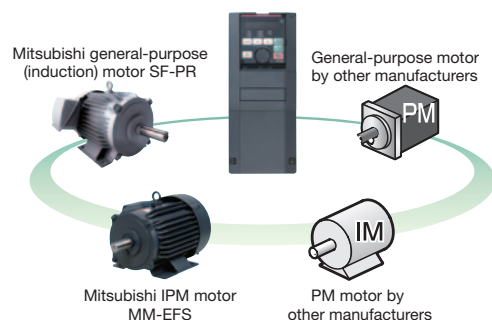
## ② Energy Saving with High-Efficiency Motor

In the international context of global warming prevention, many countries in the world have started to introduce laws and regulations to mandate manufacturing and sales of high-efficiency motors. With the use of high-efficiency motors, further energy saving is achieved.

**[IE code]**
As an international standard of the efficiency, IEC60034-30 (energy-efficiency classes for single-speed, three-phase, cage-induction motors) was formulated in October 2008. The efficiency is classified into four classes from IE1 to IE4. The larger number means the higher efficiency.

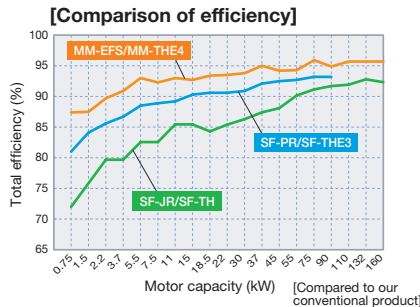| Efficiency class IEC 60034-30 | Mitsubishi motor efficiency | |
|---|---|---|
| | General-purpose motor | IPM motor |
| IE4 (super premium efficiency)*3 | ―― | Premium high-efficiency IPM (MM-EFS/MM-THE4) |
| IE3 (premium efficiency) | Superline premium series (SF-PR) | ―― |
| IE2 (high efficiency) | Superline eco series (SF-HR) | ―― |
| IE1 (standard efficiency) | Superline series (SF-JR) | ―― |
| Below the class | | ―― |

High ← Efficiency → Low

*3: The details of IE4 are specified in IEC 60034-31.

### Further energy saving with the premium high-efficiency IPM motor

**MM-EFS / MM-THE4**

- The IPM motor, with permanent magnets embedded in the rotor, achieves even higher efficiency as compared to the general-purpose motor (SF-PR/SF-THE3).
- The IM driving setting can be switched to IPM driving setting by only one setting. ("12" (MM-EFS/MM-THE4) in the parameter [IPM]. Refer to page 115 for details.)

Do not drive an IPM motor in the induction motor control settings.

**[Comparison of efficiency]**



Total efficiency (%) vs Motor capacity (kW)
MM-EFS/MM-THE4
SF-PR/SF-THE3
SF-JR/SF-TH
[Compared to our conventional product]

#### Why is an IPM motor more efficient?

·No current flows to the rotor (secondary side), and no secondary copper loss is generated.
·Magnetic flux is generated with permanent magnets, and less motor current is required.
·Embedded magnets provide reluctance torque*4, and the reluctance torque can be applied.

*4: Reluctance torque occurs due to magnetic imbalance on the rotor.

**[Comparison of motor losses]**
* Example of 22 kW motors

General-purpose motor
Iron loss
Primary copper loss (stator side)
Secondary copper loss (rotor side)
Others
100%
SF-JR

Premium high-efficiency IPM motor
Iron loss
Primary copper loss
Others
40%
MM-EFS

### Excellent compatibility with the high-performance energy-saving motor
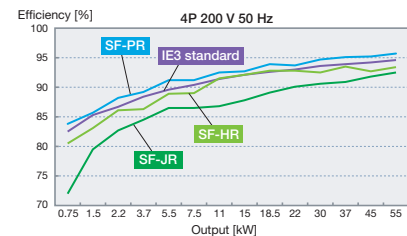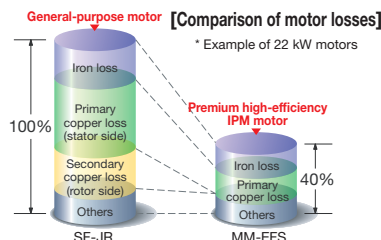
**SF-PR**

Motor constants are stored in the inverter. Energy-saving operation can be started just by setting parameters. The SF-PR motor conforms to the Japanese domestic Top Runner Standard (IE3 equivalent). Its energy-saving operation contributes reduction in the electricity charges, which in turn lowers the running cost.
Refer to page 107 for the other features.

Efficiency [%] — 4P 200 V 50 Hz
SF-PR
IE3 standard
SF-HR
SF-JR
Output [kW]

## ③ Energy-Saving Functions Suitable for Various Systems

### Standby power reduction

**NEW**
- With the 24 VDC external power supply, the input MC signal can be turned OFF after the motor is stopped, and turned ON before activating the motor. The inverter enables self power management to reduce standby power.
- The inverter cooling fan can be controlled depending on the temperature of the inverter heatsink. Also, signals can be output in accordance with the inverter cooling fan operation. When the fan is installed on the enclosure, the enclosure fan can be synchronized with the inverter cooling fan. Extra power consumption when the motor is stopped can be reduced.

Power board
MC
STF signal
MC signal
For control power supply
24 VDC power supply
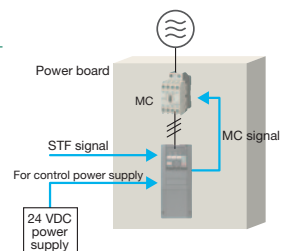
### Energy saving at a glance

**Energy saving monitor / Pulse train output of output power**

- Energy saving monitor is available. The energy saving effect can be checked using an operation panel, output terminal, or network.
- The output power amount measured by the inverter can be output in pulses. The cumulative power amount can be easily checked.

(This function cannot be used as a meter to certify electricity billings.)
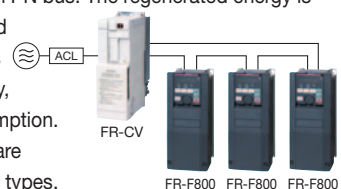
*Furthermore* With the Mitsubishi energy measuring module, the energy saving effect can be displayed, measured, and collected.

### Effective use of the regenerative energy  **Option**

**FR-CV / FR-HC2**

Multiple inverters can be connected to the power regeneration common converter (FR-CV) or the high power factor converter (FR-HC2) through a common PN bus. The regenerated energy is used by another inverter, and if there is still an excess, it is returned to the power supply, saving on the energy consumption. The 355K or higher models are inverter-converter separated types, which are suitable for power regeneration.

ACL
FR-CV
FR-F800  FR-F800  FR-F800

# FUNCTIONS IDEAL FOR FANS AND PUMPS

## 1 Optimum Inverter Capacity Selection

### Multiple rating

The rating can be selected between the two types (LD (light duty) or SLD (superlight duty)) depending on the load of the fan/pump to be used. The optimum inverter capacity can be selected suitable for the motor to be used.

For the 200 V class 90K or higher and the 400 V class 75K or higher, a motor with one-rank higher capacity can be combined.

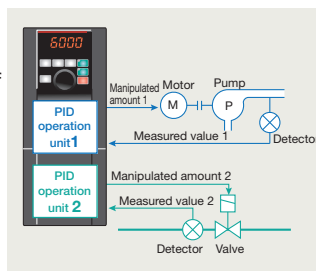| Load | Rating | Overload current rating |
|---|---|---|
| Superlight duty | SLD rating | 110% 60 s, 120% 3 s (inverse-time characteristics) at surrounding air temperature 40°C |
| Light duty | LD rating | 120% 60 s, 150% 3 s (inverse-time characteristics) at surrounding air temperature 50°C |

For the list of inverters by rating, refer to page 10.

## 2 Further Enhanced PID Control

### System cost reduction  PID multiple loops (two loops)

Two PID operation units are available in the inverter. The inverter can perform PID control of the motor operation and control the external equipment at the same time. The system cost can be reduced because no external PID controller is required for controlling the external equipment.
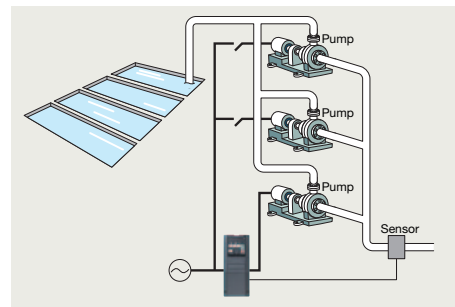


### Direct setting of the PID set point

The PID set point can be set directly from the operation panel. The setting can be easily changed at hand.

### Visibility improvement  Option

With the optional LCD operation panel (FR-LU08), the unit can be changed from "%" to other easy-to-see units. Maintenance and adjustment is facilitated by using a familiar unit of air volume, temperature, etc. for indication.
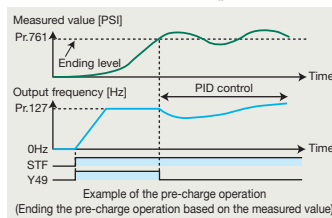
LCD operation panel (FR-LU08) (Option)



Unit conversion

### Avoidance of rapid acceleration/deceleration using PID action

#### PID pre-charge function

Before PID action, the water flow to the pipe is controlled by operating the motor at a constant speed until the measured value (pressure, etc.) reaches the set level. This function is used to avoid rapid acceleration/deceleration caused by starting the PID action while the pipe is empty, and prevent a water hammer action, etc.



Example of the pre-charge operation
(Ending the pre-charge operation based on the measured value)

### Water volume control with multiple pumps

#### Multi-pump function

By controlling the pumps connected in parallel (up to four pumps) by the PID control by one inverter, water volume, etc. can be adjusted.

One of the connected pumps is driven by the inverter. Other pumps are driven by commercial power supply. The number of pumps to be driven by commercial power supply is automatically adjusted according to the water volume.



### Energy saving in low-speed operation

#### PID output shutoff (sleep) function

During PID control, the operation is stopped when the deviation (set point - measured value) is small and the output frequency is low, and the operation is restarted when the deviation becomes large. This function restricts energy consumption during low-speed operation with low motor efficiency.

### Shorter start-up time under PID control

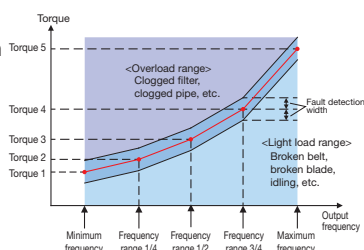#### PID automatic switchover function

The operation is started without PID control until the output frequency reaches the specified frequency. PID control is automatically started when the output frequency reaches the specified frequency. The system can be started faster at the start of operation.

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## ❸ Operating Status Monitoring

### NEW Detection of mechanical faults

#### Load characteristics measurement function

The speed/torque relationship is stored while no fault occurs. By comparing the present load status with the stored load characteristics, out-of-range warnings can be output if applicable. Mechanical faults such as clogging of the filter or breakage of the belt can be easily detected, and maintenance is facilitated.



### ❹ Smooth Restart

#### Automatic restart after instantaneous power failure / flying start function

After an instantaneous power failure, the operation is restartable from the coasting motor speed. With the advanced flying start function, the operation can be smoothly started from low speed.



Coasts during instantaneous power failure

Automatic restart after instantaneous power failure function

### ❺ Keep Running during Flying Start Operation

#### Regeneration avoidance function

The operation frequency is automatically increased to prevent the regenerative overvoltage fault from occurring. This function is useful when a load is forcibly rotated by another fan in the duct.

### ❻ PLC Control with an Inverter

### NEW PLC function in the inverter

- Parameters and setting frequency can be changed at the program. Control programs can be created in sequence ladders using the inverter setup software (FR Configurator2).
- Inverter control such as inverter operations triggered by input signals, signal output based on inverter operation status, and monitor output can be freely customized based on the machine specifications.
- All machines can be controlled by the inverter alone, and control can also be dispersed.
- Time-based operation is possible by using in combination with the real-time clock function (when using an optional LCD operation panel (FR-LU08)).



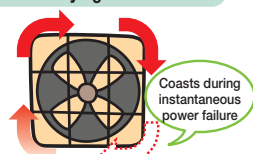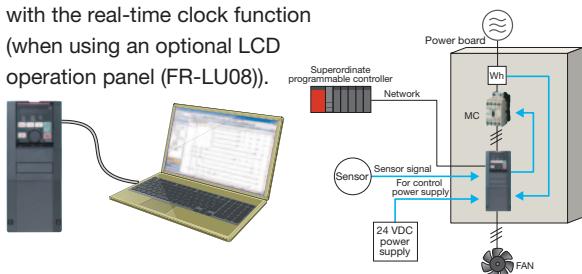### NEW Cleaning of fans and pumps

#### Cleaning function

Foreign matter on the impellers or fans of pumps can be removed by repeating forward/reverse rotation and stopping of the motor. (Use this function when a back flush does not pose a problem.) This function can be also automatically started when the result of load characteristics measurement is out of range (overload).

### ❼ Compatibility with Various Systems

#### Compatibility with various networks

It supports BACnet® MS/TP as standard, as well as Mitsubishi inverter protocol and Modbus-RTU (binary) protocol. Communication options are also available for the major network protocols such as CC-Link, CC-Link IE Field, LONWORKS® (to be supported soon), FL-net remote I/O (to be supported soon), PROFIBUS-DPV0, and DeviceNet™.

BACnet® is a registered trademark of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), LONWORKS® is a registered trademark of Echelon Corporation, DeviceNet™ is a trademark of the ODVA, and PROFIBUS is a trademark of the PROFIBUS User Organization.
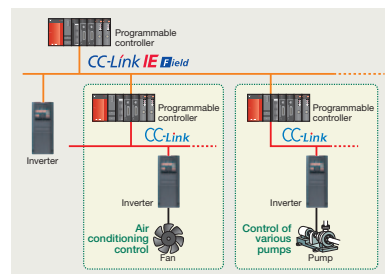


#### Simplified external equipment

The CA-type inverters are available. For the CA type, the monitor output terminal FM/CA operates as terminal CA (analog current output 0 to 20 mA), not as terminal FM (pulse train output). An external converter is not required. (The factory setting is different for the CA type and the FM type. (Refer to page 9.))

### ❽ Mechanical Resonance Suppression

#### Speed smoothing control

Vibration caused by mechanical resonance can be reduced. (Available with general-purpose motors)

### NEW ❾ Extended Functions

#### Support for up to three types of options

Three types of plug-in options can be attached. The functions of the inverter can be extended through network. For example, additional I/O terminals can be used.
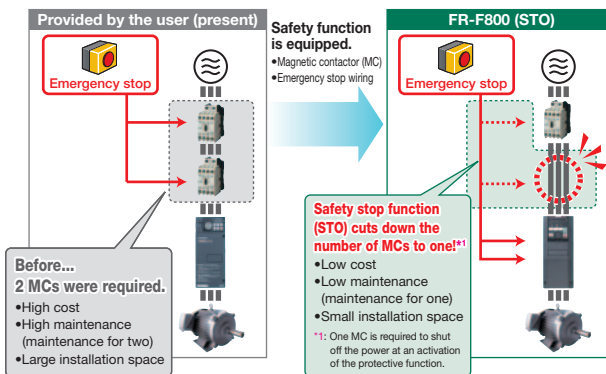
# 3 SECURITY & SAFETY

## 1 Improved System Safety

### NEW Safety standards compliance

Controls with safety functions can be easily performed. PLd and SIL2 are supported as standard. (STO)
• EN ISO 13849-1 PLd / Cat.3
• EN 61508, EN61800-5-2 SIL2



**Provided by the user (present)**

Emergency stop

**Safety function is equipped.**
• Magnetic contactor (MC)
• Emergency stop wiring

**FR-F800 (STO)**

Emergency stop

**Before...**
**2 MCs were required.**
• High cost
• High maintenance (maintenance for two)
• Large installation space

**Safety stop function (STO) cuts down the number of MCs to one!*1**
• Low cost
• Low maintenance (maintenance for one)
• Small installation space

*1: One MC is required to shut off the power at an activation of the protective function.

## 2 Reliable and Secure Maintenance

### NEW Standard 24 VDC power supply for the control circuit

In addition to the existing power supply input terminals (R1 and S1) of the control circuit, 24 VDC input is equipped as standard.

The 24 VDC power supplied from outside can be fed to the control circuit locally.
The parameter setting and communication operation can be done without turning ON the main power.



OFF    24 VDC

24 V external power supply input indication
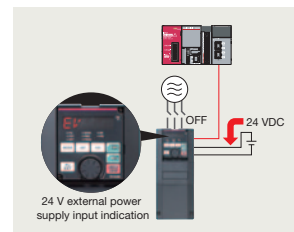
### NEW Prevention of trouble with temperature monitoring

The inverter is equipped with an internal temperature sensor, which outputs a signal when the internal temperature is high. This facilitates the detection of rises in temperature inside the inverter following cooling fan malfunction, or rises in the surrounding air temperature due to inverter operating conditions.

## 3 Quick Reaction to Troubles

### NEW Easy fault diagnosis

• The operating status (output frequency, etc.) immediately before the protection function activates can be stored in the inverter built-in RAM with the trace function. Stored data (trace data) can be copied to a USB memory device, facilitating easy trouble analysis at a separate location by reading into FR Configurator2.

Trace data stored in the built-in RAM is deleted when the power is turned OFF or the inverter is reset.



Graph function (FR Configurator2)
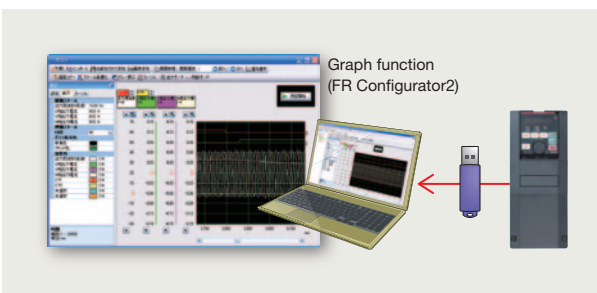
• Clock setting is now available in addition to the already-available cumulative energization time. The time and date at a protective function activation are easily identified. (The clock is reset at power-OFF.) The date and time are also saved with the trace data, making the fault analysis easier.
By using the real-time clock function with the optional LCD operation panel (FR-LU08) (when using battery), the time is not reset even when the power supply is turned OFF.

FR-LU08 (LCD type) (Option)

## 4 Protection of Critical Parameter Settings

### Misoperation prevention by setting a password

- Setting a 4-digit password can restrict parameter reading/writing.

## 5 Long Life Components and Life Check Function

### Long life components

- The service life of the cooling fans is now 10 years[*1].
  The service life can be further extended by ON/OFF control of the cooling fan.
- Capacitors with a design life of 10 years [*1*2] are adapted.
- Life indication of life components

| Components | Estimated lifespan of the FR-F800[*1] | Guideline of JEMA[*3] |
|---|---|---|
| Cooling fan | 10 years | 2 to 3 years |
| Main circuit smoothing capacitor | 10 years[*2] | 5 years |
| Printed board smoothing capacitor | 10 years[*2] | 5 years |

*1 Surrounding air temperature: Annual average of 40°C (free from corrosive gas, flammable gas, oil mist, dust and dirt).
   The design life is a calculated value and is not a guaranteed product life.
*2 Output current: 80% of the inverter rating
*3 Excerpts from "Periodic check of the transistorized inverter" of JEMA (Japan Electrical Manufacturer's Association).

### NEW Enhanced life check function

- An internal thermal sensor is equipped to all inverters as standard, which enables monitoring of the installation environment. Use this function as a guide for the life diagnosis.
- Maintenance timers are available for up to three peripheral devices, such as a motor and bearings.
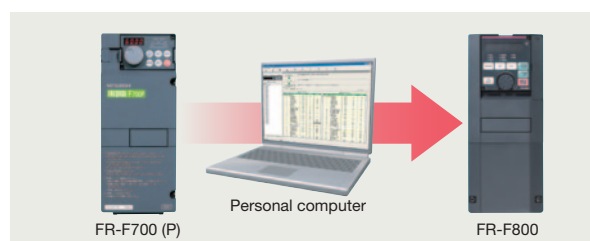
"Maintenance 1 output" warning
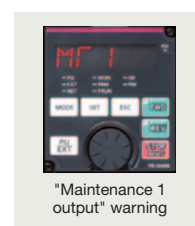
## 6 Renewal Assurance

### Compatibility with existing models

- The inverter installation method is the same as that for the FR-F700(P) series, eliminating any concerns over replacement (except for some capacity models).
  Furthermore, the FR-F700(P) series control circuit terminal blocks can be installed with the use of an option (FR-A8TAT).

- NEW The terminal response adjustment function allows a user to adjust the response speed in accordance with the existing facility. (The response time is shorter for the FR-F800 series.)
- In addition to the FR-F700(P) series' parameter settings, the FR-F500 series parameter settings (to be supported soon) can be easily copied to the FR-F800 series by using the conversion function of FR Configurator2.
  (Refer to page 15 for FR Configurator2.)

FR-F700 (P)　　Personal computer　　FR-F800

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# 4 COMPATIBILITY WITH THE ENVIRONMENT

## 1 Suppression of Outgoing Harmonic Current and EMI

•Harmonic current may adversely affect the power supply. To suppress such harmonic current, the power-factor-improving compact AC reactor

AC reactor (FR-HAL)    DC reactor (FR-HEL)

(FR-HAL) and the DC reactor (FR-HEL) are available. (For the 75K or higher inverter, always connect a DC reactor. Select a DC reactor according to the applied motor capacity.)

•By attaching the EMC filter connector to the ON or OFF position, the built-in EMC filter can be set enabled/disabled[1][2]. When it is enabled, the inverter conforms to the EMC Directive (EN61800-3/2nd Environment Category C3[3]) by itself.
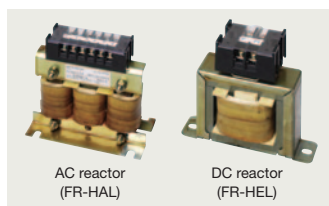
[1]: Enabling the EMC filter increases leakage current.
[2]: The input side common mode choke, which is built in the 55K or lower inverter, is always enabled regardless of the EMC filter ON/OFF connector setting.
[3]: Refer to the EMC Installation Guidelines for the required specifications.

|  | Capacitive filter | Common mode choke | DC reactor |
|---|---|---|---|
| 55K or lower | Standard (built-in) | Standard (built-in) | Option (sold separately) |
| 75K or higher | Standard (built-in) | Option (sold separately) | Option (sold separately) |

•The F800 series inverters are equipped with built-in capacitive filters (capacitors) and common mode chokes (55K or lower). By installing a DC reactor (FR-HEL), which is available as an option, they can confirm to the Architectural Standard Specifications (Electric Installation) and the Architectural Standard Specifications (Machinery Installation) (2013 revision) supervised by the Ministry of Land, Infrastructure, Transport and Tourism of Japan.

•With a high power factor converter (FR-HC2), the inverter is equivalent to a self-excitation three-phase bridge circuit in the "Harmonic Suppression Guidelines for Specific Consumers" in Japan, and realizes the equivalent capacity conversion coefficient K5=0. For the 355K or higher, the converter is separated. Therefore, installation space can be saved when connecting the FR-HC2.

## 2 Protected in Hazardous Environments

Inverters with circuit board coating (IEC60721-3-3 3C2/3S2) and plated conductors are available for improved environmental resistance. ("-60" or "-06" is affixed to the end of the inverter model name.)

## 3 Global Compatibility

•The F800 series inverters are compatible with UL, cUL, EC Directives (CE marking).
(The Radio Waves Act (South Korea) (KC mark) will be supported soon.)

•Being RoHS compliant, the FR-F800 inverters are friendly to people and the environment.

c (UL) US LISTED    CE

Compatible with UL, cUL, EC Directives (CE marking)

# 5 EASY SETUP & EASY TO USE

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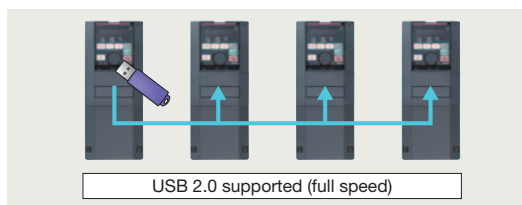
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## 1 Streamlining the Startup Process

### NEW Parameter copy with a USB memory device

A USB host connecter (A type), which allows external device connections, has been added.
Parameters can be copied to commercial USB memory devices.

USB 2.0 supported (full speed)

### NEW Easy setup with FR Configurator2

- With the sense of unity with other Mitsubishi FA products with common MELSOFT design and operability, the software is easy to use.
- Easy plug-and-play connection is available to the USB terminal equipped as standard.

FR Configurator2    Mini B connector

MELSOFT

USB cable    Inverter
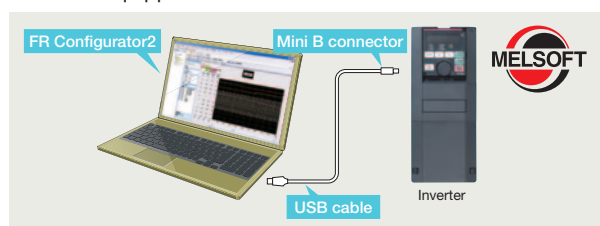
- A trial version, which contains start-up functions, is available. It can be downloaded at Mitsubishi Electric FA Global Website. (Refer to page 15 for FR Configurator2.)

### NEW Easy wiring to the control circuit

Spring clamp terminals have been adopted for control circuit terminals.
As compared to the conventional screw terminals, spring clamp terminals are highly reliable and can be easily wired. Round crimping terminals can also be used by employing a control terminal option (to be released soon).

Easy wiring. Just insert.

Assures the tensile strength of the DIN standards.
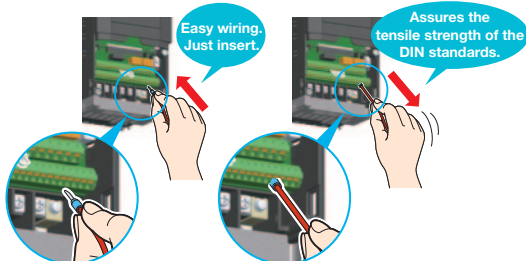
## 2 Easy-to-follow Display Improves the Operability

### NEW Easy operation with GOT

- Automatic communication is possible without specifying any parameter settings simply by connecting to the GOT2000 series.
- The PLC function device monitor can be displayed at the GOT2000 series. Batch control of multiple inverter device monitors is possible with a single GOT unit.
- The sample screen data for the FR-F800 can be found in the screen design software of the GOT2000 series (to be supported soon). For the latest version of the screen design software, please contact your local sales office.

GOT2000

### NEW Easy-to-follow parameter configuration

With the parameter setting mode selection of the operation panel, the group parameter mode can be selected to provide intuitive and simple parameter settings. (The conventional parameter setting mode is selected by default.)

Conventional parameter (F700(P))   Pr.  1 2 7

New parameter (F800)   Pr.  A + 6 + 1 2
Major division  Minor division   Group number  Parameter number

| Major division | Name |
| --- | --- |
| E | Environment |
| F | Acceleration/deceleration |
| D | Start and frequency commands |
| H | Protective function |
| M | Monitor |
| T | Multiple function input terminals |
| C | Motor constant |
| A | Applications |
| N | Communication |
| G | Control |

### NEW Easy-to-read operation panel

A 5-digit, 12-segment display has been adopted for the operation panel (FR-DU08) for a more natural character display. Furthermore, an optional operation panel (FR-LU08) adopting an LCD panel capable of displaying text and menus is also available.

FR-DU08 (12-segment type)    FR-LU08 (LCD type) (Option)
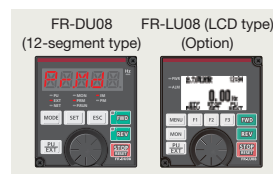
## 3 To Aid with Maintenance

### Reduced wiring check time

Split-type covers are adapted for all capacity models. Maintenance is now easy because all an operator has to do is to remove the cover for the target wiring area.
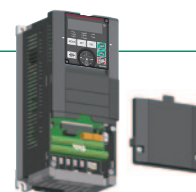
### NEW Maintenance and control of multiple inverters  Option

Serial number reading is possible using the optional LCD operation panel (FR-LU08) or the inverter setup software (FR Configurator2). Administration of different inverters has become much more simple.

## Wide range of lineup

### Inverter

**Standard model**

**F R - F 8 2 0 - 0.75K -1 ☐**

| Symbol | Voltage class |
|---|---|
| 2 | 200 V class |
| 4 | 400 V class |

| Symbol | Structure, functionality |
|---|---|
| 0 | Standard model |

| Symbol*1 | Description |
|---|---|
| 0.75K to 315K | LD rated inverter capacity (kW) |

| Symbol | Type |
|---|---|
| -1 | FM |
| -2 | CA*2 |

| Symbol | Circuit board coating (IEC60721-3-3 3C2/3S2 compatible) | Plated conductor |
|---|---|---|
| None | Without | Without |
| -60 | With | Without |
| -06 | With | With |

| Three-phase 200 V class FR-F820-[]*3 | 0.75K | 1.5K | 2.2K | 3.7K | 5.5K | 7.5K | 11K | 15K | 18.5K | 22K | 30K | 37K | 45K | 55K | 75K | 90K | 110K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 00046 | 00077 | 00105 | 00167 | 00250 | 00340 | 00490 | 00630 | 00770 | 00930 | 01250 | 01540 | 01870 | 02330 | 03160 | 03800 | 04750 |
| | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |

| Three-phase 400 V class FR-F840-[]*3 | 0.75K | 1.5K | 2.2K | 3.7K | 5.5K | 7.5K | 11K | 15K | 18.5K | 22K | 30K | 37K | 45K | 55K | 75K | 90K | 110K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 00023 | 00038 | 00052 | 00083 | 00126 | 00170 | 00250 | 00310 | 00380 | 00470 | 00620 | 00770 | 00930 | 01160 | 01800 | 02160 | 02600 |
| | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | 132K | 160K | 185K | 220K | 250K | 280K | 315K | | | | | | | | | | |
| | 03250 | 03610 | 04320 | 04810 | 05470 | 06100 | 06830 | | | | | | | | | | |
| | ● | ● | ● | ● | ● | ● | ● | | | | | | | | | | |

**Separated converter type**

**F R - F 8 4 2 - 355K -1 ☐**

| Symbol | Voltage class |
|---|---|
| 4 | 400 V class |

| Symbol | Structure, functionality |
|---|---|
| 2 | Separated converter type |

| Symbol*1 | Description |
|---|---|
| 355K to 560K | LD rated inverter capacity (kW) |

| Symbol | Type |
|---|---|
| -1 | FM |
| -2 | CA*2 |

| Symbol | Circuit board coating (IEC60721-3-3 3C2/3S2 compatible) | Plated conductor |
|---|---|---|
| None | Without | Without |
| -60 | With | Without |
| -06 | With | With |

| Three-phase 400 V class FR-F842-[]*4 | 355K | 400K | 450K | 500K | 560K |
|---|---|---|---|---|---|
| | 07700 | 08660 | 09620 | 10940 | 12120 |
| | ● | ● | ● | ● | ● |

*1: Models can be alternatively indicated with the rated inverter current (SLD rating).
*2: Specification differs by the type as follows.

| Type | Monitor output | Initial setting | | | | |
|---|---|---|---|---|---|---|
| | | Built-in EMC filter | Control logic | Rated frequency | Pr.19 Base frequency voltage | Pr.570 Multiple rating setting |
| FM (terminal FM equipped model) | Terminal FM (pulse train output) Terminal AM (analog voltage output (0 to ±10 VDC)) | OFF | Sink logic | 60Hz | 9999 (same as the power supply voltage) | 1 (LD rating) |
| CA (terminal CA equipped model) | Terminal CA (analog current output (0 to 20 mADC)) Terminal AM (analog voltage output (0 to ±10 VDC)) | ON | Source logic | 50Hz | 8888 (95% of the power supply voltage) | 0 (SLD rating) |

*3: For the 75K or higher inverter, always connect a DC reactor (FR-HEL), which is available as an option.
   Select a DC reactor according to the applied motor capacity.
*4: Always install the converter unit (FR-CC2). (Not required when a high power factor converter (FR-HC2) is used)

### Converter unit

**F R - C C 2 - H 355K -60**

| Symbol | Voltage class |
|---|---|
| H | 400 V class |

| Symbol | Description |
|---|---|
| 355K to 630K | Applicable motor capacity (kW) |

| Symbol | Circuit board coating (IEC60721-3-3 3C2/3S2 compatible) | Plated conductor |
|---|---|---|
| -60 | With | Without |
| -06 | With | With |

| Three-phase 400 V class FR-CC2-H[] (with the built-in DC reactor) | 355K | 400K | 450K | 500K | 560K | 630K |
|---|---|---|---|---|---|---|
| | ● | ● | ● | ● | ● | ● |

●: Released model

9

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## Wide range of lineup

### Premium high-efficiency IPM motor

**55 kW or lower**  M M - E F S 7 1M 4 □ □

| Symbol | Output | Symbol | Output | Symbol | Output |
|--------|--------|--------|--------|--------|--------|
| 7 | 0.75 kW | 75 | 7.5 kW | 30K | 30 kW |
| 15 | 1.5 kW | 11K | 11 kW | 37K | 37 kW |
| 22 | 2.2 kW | 15K | 15 kW | 45K | 45 kW |
| 37 | 3.7 kW | 18K | 18.5 kW | 55K | 55 kW |
| 55 | 5.5 kW | 22K | 22 kW | | |

| Symbol | Rated speed[*1] |
|--------|------------|
| 1M | 1500 r/min |

| Symbol | Voltage class |
|--------|---------------|
| None | 200 V |
| 4 | 400 V |

| Symbol | Specifications[*2] |
|--------|----------------|
| None | Standard model |
| Q | Class B |

| Symbol | Specifications[*2] |
|--------|----------------|
| None | Standard model |
| P1 | Outdoor type |

*1: The motor can also be used for applications which required the rated speed of 1800 r/min.
*2: The outdoor type and class B are semi-standard models.

**75 kW or higher**  M M - T H E 4

- The motor can be used for applications which required the rated speed of 1500 r/min and 1800 r/min.
- For dedicated motors such as the outdoor type, the long-axis type, the flange type, the waterproof outdoor type, and the corrosion proof type, contact your sales representative.

| Rated output (kW) | | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 | 75 | 90 | 110 | 132 | 160 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Motor model | | 7 | 15 | 22 | 37 | 55 | 75 | 11K | 15K | 18K | 22K | 30K | 37K | 45K | 55K | — | — | — | — | — |
| 200 V class | MM-EFS[]1M | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | — | — | — | — | — |
| 400 V class | MM-EFS[]1M4 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | — | — | — | — | — |
| 200 V class | MM-THE4 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | ● | — | — | — | — |
| 400 V class | | — | — | — | — | — | — | — | — | — | — | — | — | — | — | ● | ● | ● | ● | ● |

**< Note >** 
- The IPM motor MM-EFS/MM-THE4 series cannot be driven by the commercial power supply.
- For IPM motors, the total wiring length is 100 m maximum.
- Only one IPM motor can be connected to an inverter.

**●**: Released model   **—**: Not applicable

### Inverter by rating

**•200 V class**

| Inverter model FR-F820-[] | | SLD (superlight duty) Motor capacity (kW)[*1] | SLD Rated current (A) | LD (light duty, initial value) Motor capacity (kW)[*1] | LD Rated current (A) |
|---|---|---|---|---|---|
| 0.75K | 00046 | 0.75 | 4.6 | 0.75 | 4.2 |
| 1.5K | 00077 | 1.5 | 7.7 | 1.5 | 7 |
| 2.2K | 00105 | 2.2 | 10.5 | 2.2 | 9.6 |
| 3.7K | 00167 | 3.7 | 16.7 | 3.7 | 15.2 |
| 5.5K | 00250 | 5.5 | 25 | 5.5 | 23 |
| 7.5K | 00340 | 7.5 | 34 | 7.5 | 31 |
| 11K | 00490 | 11 | 49 | 11 | 45 |
| 15K | 00630 | 15 | 63 | 15 | 58 |
| 18.5K | 00770 | 18.5 | 77 | 18.5 | 70.5 |
| 22K | 00930 | 22 | 93 | 22 | 85 |
| 30K | 01250 | 30 | 125 | 30 | 114 |
| 37K | 01540 | 37 | 154 | 37 | 140 |
| 45K | 01870 | 45 | 187 | 45 | 170 |
| 55K | 02330 | 55 | 233 | 55 | 212 |
| 75K | 03160 | 75 | 316 | 75 | 288 |
| 90K | 03800 | 90/110 | 380 | 90 | 346 |
| 110K | 04750 | 132 | 475 | 110 | 432 |

**•400 V class**

| Inverter model FR-F84[]-[] | | SLD (superlight duty) Motor capacity (kW)[*1] | SLD Rated current (A) | LD (light duty, initial value) Motor capacity (kW)[*1] | LD Rated current (A) |
|---|---|---|---|---|---|
| 0.75K | 00023 | 0.75 | 2.3 | 0.75 | 2.1 |
| 1.5K | 00038 | 1.5 | 3.8 | 1.5 | 3.5 |
| 2.2K | 00052 | 2.2 | 5.2 | 2.2 | 4.8 |
| 3.7K | 00083 | 3.7 | 8.3 | 3.7 | 7.6 |
| 5.5K | 00126 | 5.5 | 12.6 | 5.5 | 11.5 |
| 7.5K | 00170 | 7.5 | 17 | 7.5 | 16 |
| 11K | 00250 | 11 | 25 | 11 | 23 |
| 15K | 00310 | 15 | 31 | 15 | 29 |
| 18.5K | 00380 | 18.5 | 38 | 18.5 | 35 |
| 22K | 00470 | 22 | 47 | 22 | 43 |
| 30K | 00620 | 30 | 62 | 30 | 57 |
| 37K | 00770 | 37 | 77 | 37 | 70 |
| 45K | 00930 | 45 | 93 | 45 | 85 |
| 55K | 01160 | 55 | 116 | 55 | 106 |
| 75K | 01800 | 75/90 | 180 | 75 | 144 |

| Inverter model FR-F84[]-[] | | SLD (superlight duty) Motor capacity (kW)[*1] | SLD Rated current (A) | LD (light duty, initial value) Motor capacity (kW)[*1] | LD Rated current (A) |
|---|---|---|---|---|---|
| 90K | 02160 | 110 | 216 | 90 | 180 |
| 110K | 02600 | 132 | 260 | 110 | 216 |
| 132K | 03250 | 160 | 325 | 132 | 260 |
| 160K | 03610 | 185 | 361 | 160 | 325 |
| 185K | 04320 | 220 | 432 | 185 | 361 |
| 220K | 04810 | 250 | 481 | 220 | 432 |
| 250K | 05470 | 280 | 547 | 250 | 481 |
| 280K | 06100 | 315 | 610 | 280 | 547 |
| 315K | 06830 | 355 | 683 | 315 | 610 |
| 355K | 07700 | 400 | 770 | 355 | 683 |
| 400K | 08660 | 450 | 866 | 400 | 770 |
| 450K | 09620 | 500 | 962 | 450 | 866 |
| 500K | 10940 | 560 | 1094 | 500 | 962 |
| 560K | 12120 | 630 | 1212 | 560 | 1094 |

**•Overload current rating**

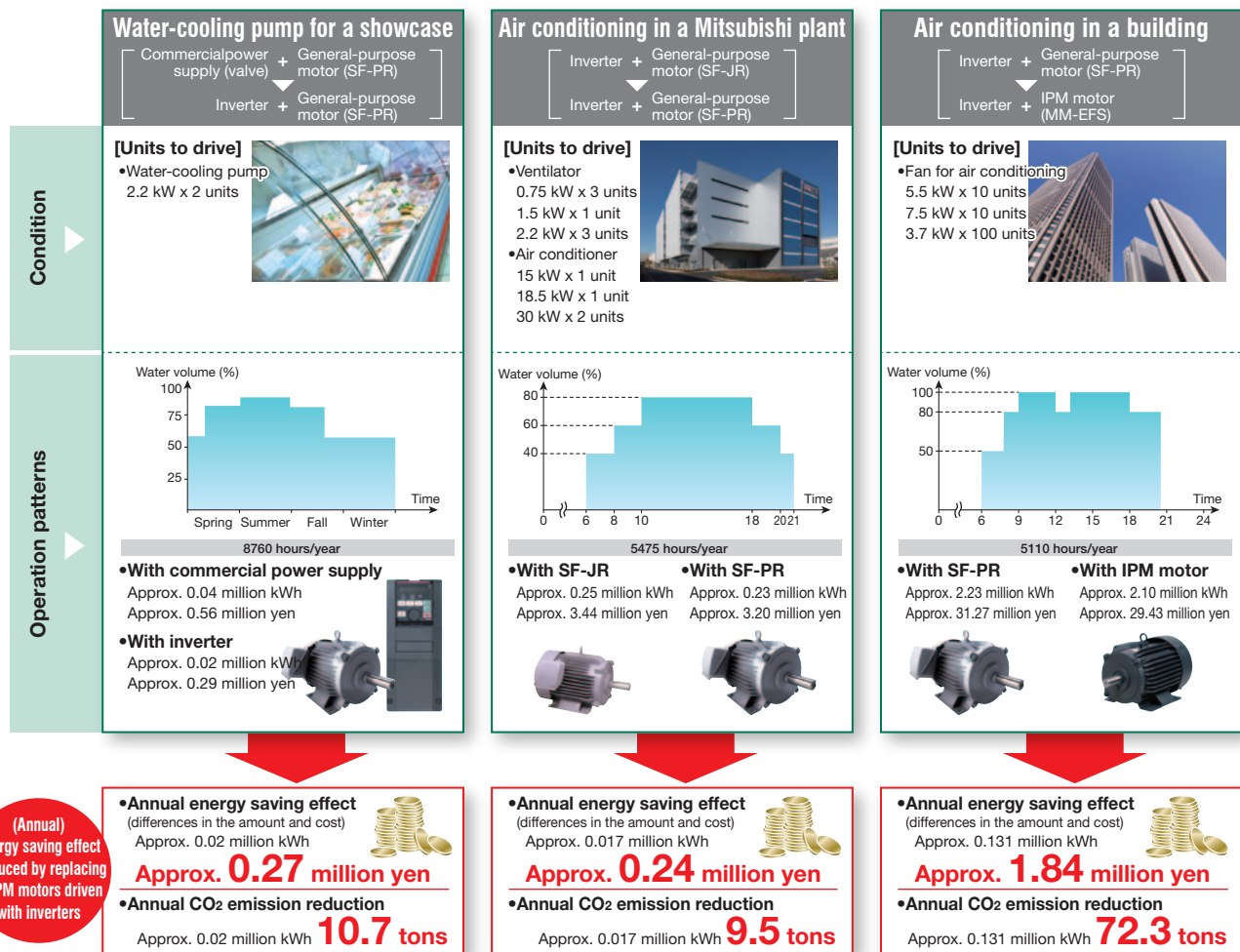| SLD | 110% 60 s, 120% 3 s (inverse-time characteristics) at surrounding air temperature 40°C |
|---|---|
| LD | 120% 60 s, 150% 3 s (inverse-time characteristics) at surrounding air temperature 50°C |

*1: Indicates the maximum capacity applicable with the Mitsubishi 4-pole standard motor.

☞ For selection of the DC reactor and the converter unit, refer to page 106.

# Trial Calculation Example of Energy Saving Effect

## The longer the operating period with medium air volume is, the higher energy saving effect obtained with an inverter.

(Conditions: The electricity cost is 14 yen/kWh. The $CO_2$ emission is 1,000 kWh ≈ 0.55 ton-$CO_2$)

### Condition

| Water-cooling pump for a showcase | Air conditioning in a Mitsubishi plant | Air conditioning in a building |
|---|---|---|
| Commercial power supply (valve) + General-purpose motor (SF-PR) ▼ Inverter + General-purpose motor (SF-PR) | Inverter + General-purpose motor (SF-JR) ▼ Inverter + General-purpose motor (SF-PR) | Inverter + General-purpose motor (SF-PR) ▼ Inverter + IPM motor (MM-EFS) |

**[Units to drive]**
- Water-cooling pump
  2.2 kW x 2 units

**[Units to drive]**
- Ventilator
  0.75 kW x 3 units
  1.5 kW x 1 unit
  2.2 kW x 3 units
- Air conditioner
  15 kW x 1 unit
  18.5 kW x 1 unit
  30 kW x 2 units

**[Units to drive]**
- Fan for air conditioning
  5.5 kW x 10 units
  7.5 kW x 10 units
  3.7 kW x 100 units

### Operation patterns

Water volume (%) — 100, 75, 50, 25 — Spring Summer Fall Winter — Time

Water volume (%) — 80, 60, 40 — 0 6 8 10 18 2021 — Time

Water volume (%) — 100, 80, 50 — 0 6 9 12 15 18 21 24 — Time

8760 hours/year

- **With commercial power supply**
  Approx. 0.04 million kWh
  Approx. 0.56 million yen
- **With inverter**
  Approx. 0.02 million kWh
  Approx. 0.29 million yen

5475 hours/year

- **With SF-JR**
  Approx. 0.25 million kWh
  Approx. 3.44 million yen
- **With SF-PR**
  Approx. 0.23 million kWh
  Approx. 3.20 million yen

5110 hours/year

- **With SF-PR**
  Approx. 2.23 million kWh
  Approx. 31.27 million yen
- **With IPM motor**
  Approx. 2.10 million kWh
  Approx. 29.43 million yen

(Annual) energy saving effect produced by replacing to IPM motors driven with inverters

- **Annual energy saving effect**
  (differences in the amount and cost)
  Approx. 0.02 million kWh
  Approx. **0.27 million yen**
- **Annual $CO_2$ emission reduction**
  Approx. 0.02 million kWh **10.7 tons**

- **Annual energy saving effect**
  (differences in the amount and cost)
  Approx. 0.017 million kWh
  Approx. **0.24 million yen**
- **Annual $CO_2$ emission reduction**
  Approx. 0.017 million kWh **9.5 tons**

- **Annual energy saving effect**
  (differences in the amount and cost)
  Approx. 0.131 million kWh
  Approx. **1.84 million yen**
- **Annual $CO_2$ emission reduction**
  Approx. 0.131 million kWh **72.3 tons**

## Your best assistant - Mitsubishi inverter software

### IPM energy savings simulation file

The IPM energy savings simulation file calculates the energy saving effect and CO2 reduction rate achieved by replacing commercial power supply (damper/valve control) operation with IPM motor operation by inverter. This file requires inputs such as the capacity, quantity, air volume, and operating time of motors.

IPM energy savings simulation file
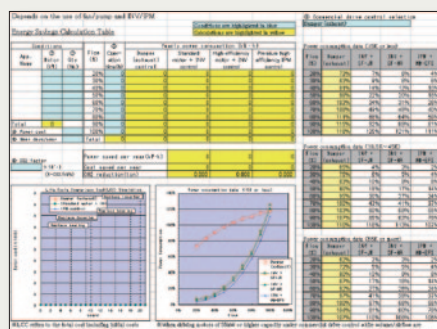
### FR Configurator2 (SW1DND-FRC2) **Option**

Support tool for the inverter operations from start-up to maintenance. Refer to page 15 for details.
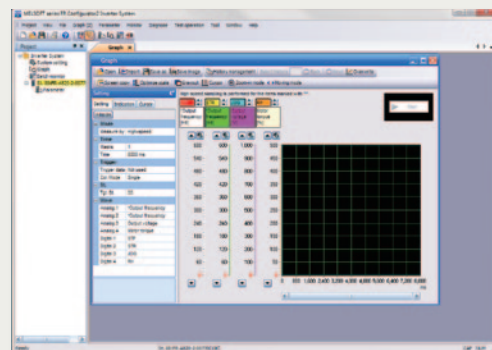
## Application example

# BEST SUITED FOR EVERY MACHINE

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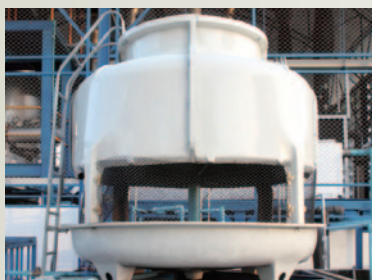
## Cooling tower

### PID control

A sensor monitors a cooling water temperature, which enables the operation corresponding to the target temperature. The system cost can be reduced because no external PID controller is required.

### Electronic bypass function

The inverter contains complicated sequence circuits for switching between the commercial power supply operation and inverter operation.
The operation can be automatically switched over to the commercial power supply operation if a fault occurs in the inverter.

## Building water pumps

### Multi-pump function `NEW`

By controlling the pumps connected in parallel (up to four pumps) by the PID control by one inverter, water volume, etc. can be adjusted.

### PID pre-charge function `NEW`

The system avoids sudden acceleration at the pump start and prevents the pump from being damaged by water hammer.

### Load characteristics measurement function `NEW`

The system quickly detects faults such as adhesion of foreign matter to the impellers, etc.

## Air conditioning of buildings

### PM motor control

Driving a PM motor, which is more efficient than an induction motor, achieves more energy savings.

### Automatic restart after instantaneous power failure / flying start function

When the power is restored after an instantaneous power failure, the operation can be restarted from the motor coasting speed. Even if a flying start changes the rotation direction, the operation can be smoothly started.

### PID control [PID forward/reverse action switchover]

The forward/reverse rotation under PID control can be switched by turning ON/OFF the signal input, which allows easy switching between the heating and cooling temperature controls.

### BACnet®MS/TP `NEW`

BACnet®MS/TP is a suitable network for use with air conditioning controls. This makes it possible to achieve efficient air conditioning controls with all-in-one management of the air conditioning in the entire building.

## Compressor

### Advanced optimum excitation control `NEW`

While saving energy just as with the conventional Optimum excitation control, the new Advanced optimum excitation control provides a large starting torque, which allows for both a large starting torque and energy saving operation.

### High-speed operation `NEW`

[Maximum output frequency]
• V/F control 590 Hz
• Advanced magnetic flux vector control 400 Hz

# FREELY CONTROL MACHINES

## The PLC function will help you to provide the control sequence best suited for the machine specifications.

### 1 Inverter operation sequence customized for the machine

•A set of operations (operation at different signal inputs, signal and monitor outputs at different inverter status, etc.) can be freely programmed in accordance with the machine specifications. For example, a shutter opening/closing can be performed based on a signal from a sensor, or based on the opening/closing times.
Control programs can be created in sequence ladders using the inverter setup software (FR Configurator2).

### 2 Realizes the decentralized control

•The control of the whole system is decentralized to inverters that mange their subordinating devices individually.

•A group of dedicated sequence programs is created and saved in each inverter. The master controller no longer has to process all the sequence programs, and the decentralized system accepts program changes more flexibly.

### 3 Automatic operation in accordance with the time

•With the real-time clock, automatic operation can be performed at certain times (when the optional LCD operation panel (FR-LU08) is used).

### 4 Useful functions

• **User parameter**
Up to 50 parameters, which are linked with the data registers, can be saved. The variables (data registers) used in the PLC function can be saved as inverter parameters. Furthermore, parameter settings can be saved in the EEPROM of inverter. When results of calculation using the PLC function are saved in the parameters, the data can be retained after the power is turned OFF.

• **User initiated fault**
Inverter output can be shut off under conditions other than those of the existing protective functions. Up to five specific fault-initiating conditions can be set to activate a protective function and shut off the inverter output.

• **Monitored item for the user**
Special register values can be displayed for monitoring on the operation panel. Arbitrary data designated by the user such as results of calculation using the PLC function can be displayed.

• **Inverter parameter read/write**
Parameter settings can be changed using sequence programs. The acceleration/deceleration patterns can also be set with sequence programs to be changed at certain operation statuses. You can choose RAM or EEPROM to save the parameter settings. When the settings are changed frequently, choose RAM.

• **PID function**
Two different loops of PID inverter operations can be pre-set, and those can be controlled using sequence programs.

• **Inverter operation lock**
The inverter operation can be restricted for the command sources other than the sequence programs.

## PLC function

| Item | Description |
|---|---|
| I/O | |
| General-purpose I/O | Sequence programs enable I/O signal transmission to/from the inverter and its plug-in options. |
| Analog I/O | Sequence programs enable reading of analog input values or analog output transmission by the inverter, and analog output transmission to the plug-in options. |
| Pulse train I/O | Sequence programs enable pulse train inputs (to terminal JOG) and pulse train outputs (from terminal F/C(FM)). |
| Inverter parameter read/write | Sequence programs enable inverter parameter write/read. |
| User parameter | Fifty user parameters (Pr.1150 to Pr.1199) are available and are linked with the data registers D206 to D255, which accept direct access by sequence programs. |
| CC-Link | A plug-in option (FR-A8NC) enables handling of remote registers as arbitrary data in the sequence programs. |
| Special function | |
| PID operation | Inverter's PID operations can be set (up to two loops). |
| User initiated fault | Up to five fault-initiating conditions can be set to activate a protective function. |
| Fault clear | The protective function occurring in the inverter can be reset. |
| Inverter operation lock | Inverters can start up while the PLC function is running. |
| Monitored item for the user | Desired data is displayable on the operation panel. |

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## Application Example

### Fountain height control

**Point**

Controlling the water pressure (rotations per minute) allows the fountain height to be changed. PLC programs allow various operation patterns to create a variety of effects.
The time-based automatic operation is possible by using the sequence programs in combination with the real-time clock function (when using an optional LCD operation panel (FR-LU08)).

**Inverter parameter read/write**

Inverter parameters can be changed through the sequence programs. The height and duration of the spouting water can be set.

FR-LU08 installed

Output frequency

Time

### Fan control

**Point**
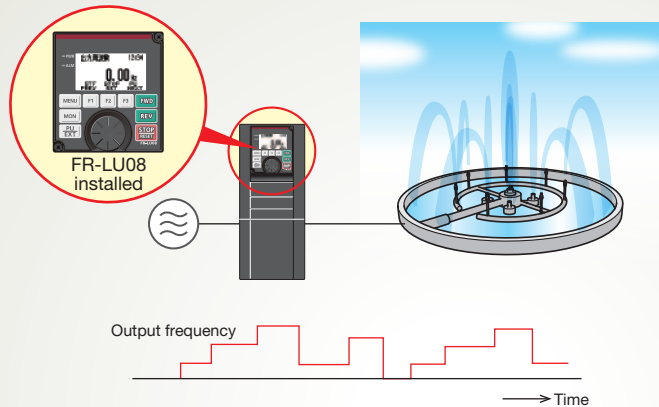
Signals sent via the enclosure (relay panel, etc.) such as input magnetic contactor signals, watt hour meter signals, and sensor signals can be read directly into the inverter and controlled. A fan can be controlled in accordance with the conditions without using relays, etc.
Furthermore, by using an external 24 VDC power source for the control power supply, input machine signals can be turned ON and OFF regardless of whether there is an input power source. And by employing an external 24 VDC power supply for the control power, input machine signals can be turned ON and OFF, regardless of the existence of a main circuit power supply.

**CC-Link**

A plug-in option (FR-A8NC) enables handling of remote registers as arbitrary data in the sequence programs.
A variety of equipment inside the factory can be centrally controlled with a CC-Link Network.

Enclosure

Host PLC

Network

Sensor

Sensor signal

Power supply for control circuit

24 VDC Power supply

Wh

MC

FAN

## FR Configurator2 (SW1DND-FRC2)    [to be supported soon]
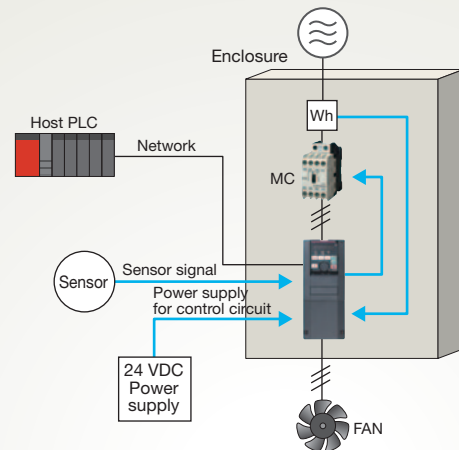
# DELIVERING A COMFORTABLE INVERTER

*From inverter startup to maintenance, this versatile software allows the user to specify settings easily at the computer.*

[Compatible operating systems]

Windows® 7, Windows® 8, Windows® 8.1/Pro/Enterprise (32-bit, 64-bit), Windows Vista® (32-bit), Windows® XP Professional SP3 or later, Windows® XP Home Edition SP3 or later

Windows is a registered trademark of Microsoft Corporation in the United States and other countries.

## Easy connection with a USB cable

A USB connector (Mini-B connector) is provided as standard. Easy connection to the computer without the need for a converter.

FR Configurator2
Mini-B connector
Computer    USB cable    Inverter
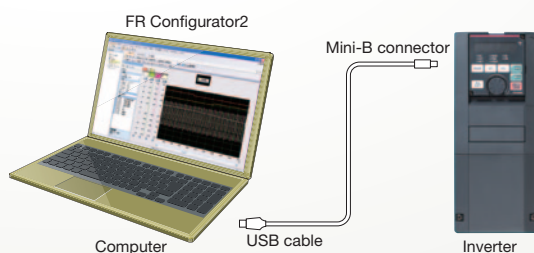
## Intuitive user interface

Connected inverters are displayed in tree view format. Windows for each function can be accessed by changing the tab for maximum efficiency.

Tree view    Tab change
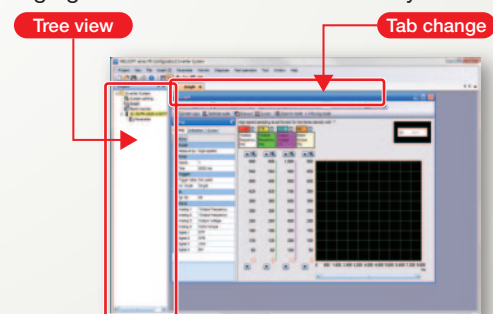
## Work can be carried out away from the equipment using a USB memory device

By loading trace data and parameter settings copied to a USB memory device into FR Configurator2, analysis and adjustments can be carried out with ease away from the equipment.

USB memory device
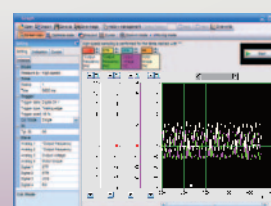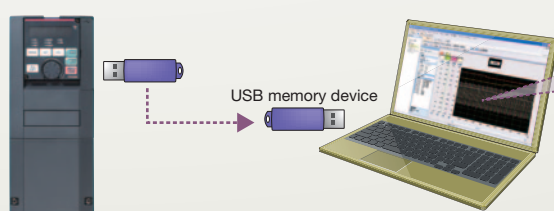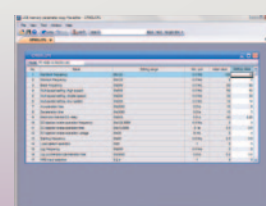
Graph function    USB parameter copy file editing

## Sequence control (Developer function)

The Developer function is used for creating sequence programs and writing them to the inverter to enable the use of the PLC function of the inverter.
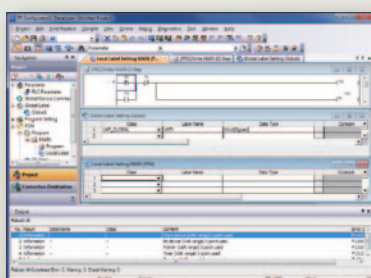
**Available in trial version**

The trial version supports the following functions. Download from the Mitsubishi Electric FA Global Website.

| Function | Trial version |
|---|---|
| Parameter list | ○ |
| Diagnosis | ○ |
| Graph | × |
| Batch monitor | × |
| Test operation | ○ |
| Conversion | ○ |
| Developer | × |
| USB memory parameters Copied file editing | × |
| Help | ○ |

○: Available,  ×: Not available

# OPERATING ENVIRONMENT

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**Startup**

## 1 Efficient startup settings

### System settings
*Available in trial version*

This sets the method used to connect the inverters and the computer. Automatic recognition of connected inverters can also be set. The station number, model, capacity, and plug-in options of the connected inverters can also be set manually.
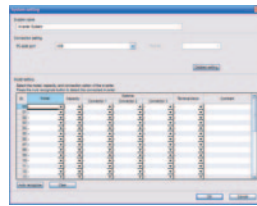
### Test operation
*Available in trial version*

Operating commands, frequency settings, and the operating mode can be set for the selected inverter.
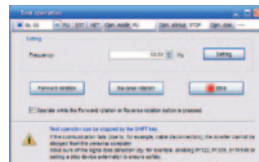
### Conversion function
*Available in trial version*

Parameters can be set with the parameter auto conversion function when renewing from the FR-F700(P) series or FR-F500 series.

FR-F500    FR-F700(P)    Computer    FR-F800
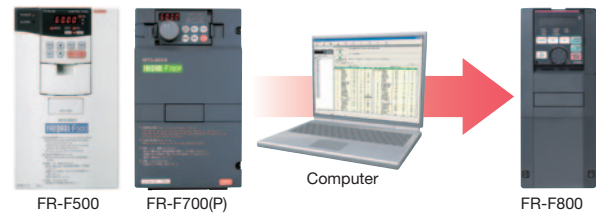
**Operation**

## 2 Perform pre-operation adjustments and checks during operation with ease

### Parameter list
*Available in trial version*

Parameters for selected station numbers can be displayed and changed.

### USB memory device parameter copy file editing

Parameter settings (USB memory device parameter copy file) read from the inverter to a USB memory device can be edited.
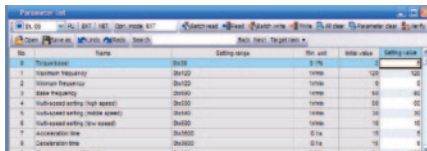
### Batch monitor function

Multiple inverter monitor items can be monitored simultaneously.

With a terminal monitor, input/output signal assignments and the ON/OFF status can be monitored.

### Offline auto tuning

Tuning is performed in wizard format after specifying necessary parameter settings.

**Maintenance**

## 3 Easy-to-follow platform facilitates easy maintenance

### Diagnosis (faults history)
*Available in trial version*

Inverter faults history can be read and displayed together with the alarm occurrence time.
Activating faults can be displayed, and inverters can also be reset.
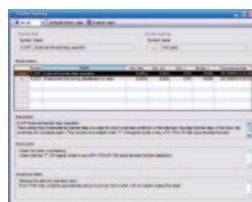
### Help
*Available in trial version*

Displays the content of inverter and software instruction manuals.
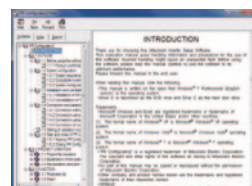
### Graph function

Inverter data can be sampled and displayed in a graphical format. Trace data can also be read and displayed in a graph.
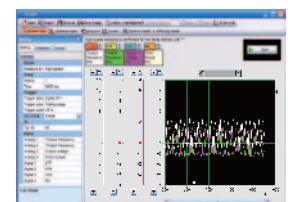
### Life diagnosis
*Available in trial version*

Life information read from the inverter is displayed.
Check marks appear in the life alarm fields of inverter parts that have exceeded their replacement schedule.
Diagnosis results can also be output to a file.

# ✤ Connection Example

## ● Connection example for standard models

**Three-phase AC power supply**
Must be within the permissible power supply specifications of the inverter.
**(Refer to page 18)**

**Moulded case circuit breaker (MCCB) or earth leakage current breaker (ELB), fuse**
Must be selected carefully since an inrush current flows in the inverter at power ON.
**(Refer to page 94)**

**Magnetic contactor (MC)**
Install this to ensure safety.
Do not use this to start and stop the inverter. Doing so will shorten the life of the inverter.
**(Refer to page 95)**

**AC reactor (FR-HAL)**
**(Refer to page 82)**

**DC reactor (FR-HEL)**
**(Refer to page 83)**

**Line noise filter (FR-BLF)**
The FR-F820-02330(55K) or lower and the FR-F840-01160(55K) or lower are equipped with the common mode choke.
**(Refer to page 84)**

For the FR-F820-03160(75K) or higher, the FR-F840-01800(75K) or higher, always connect a DC reactor. (The converter unit (FR-CC2) is equipped with the DC reactor.)

Inverter

**USB connector**
USB host
(A connector)
Communication status indicator
(LED)(USB host)

USB
**(Refer to page 42)**

**USB devuce (Mini B connector)**

**Personal computer (FR Configurator2)**
**(Refer to page 15)**

P/+ P1

R/L1 S/L2 T/L3

P/+ N/-

Earth (Ground)

**IM connection**

U V W

**PM connection**

U V W

**EMC filter (ferrite core) (FR-BSF01, FR-BLF)**
**(Refer to page 84)**

Contactor Example)
No-fuse switch (DSN type)
Connect this for an application where a PM motor is driven by the load even while the inverter power is OFF. Do not open or close the contactor while the inverter is running (outputting).
**(Refer to page 101)**

Induction motor

Earth (Ground)

**(Refer to page 106)**

IPM motor
(MM-EFS, MM-THE4)
**(Refer to page 111)**

Earth (Ground)

**Brake unit (FR-BU2)**
**(Refer to page 85)**

P/+ PR

P/+

PR

**High power factor converter (FR-HC2)**
**(Refer to page 90)**

**Power regeneration common converter (FR-CV)** **(Refer to page 88)**
**Power regeneration converter (MT-RC)**
**(Refer to page 89)**

**Resistor unit (FR-BR, MT-BR5)**
**(Refer to page 85)**

☐ : Install these options as required.

F800

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# Standard Specifications

## ● Rating (Standard model)

### ◆ 200 V class

| Model FR-F820-[ ] | | 00046 | 00077 | 00105 | 00167 | 00250 | 00340 | 00490 | 00630 | 00770 | 00930 | 01250 | 01540 | 01870 | 02330 | 03160 | 03800 | 04750 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.75K | 1.5K | 2.2K | 3.7K | 5.5K | 7.5K | 11K | 15K | 18.5K | 22K | 30K | 37K | 45K | 55K | 75K | 90K | 110K |
| Applicable motor capacity (kW) *1 | SLD | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 | 75 | 90/110 | 132 |
| | LD | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 | 75 | 90 | 110 |
| **Output** Rated capacity (kVA) *2 | SLD | 1.8 | 2.9 | 4 | 6.4 | 10 | 13 | 19 | 24 | 29 | 35 | 48 | 59 | 71 | 89 | 120 | 145 | 181 |
| | LD | 1.6 | 2.7 | 3.7 | 5.8 | 8.8 | 12 | 17 | 22 | 27 | 32 | 43 | 53 | 65 | 81 | 110 | 132 | 165 |
| Rated current (A) | SLD | 4.6 | 7.7 | 10.5 | 16.7 | 25 | 34 | 49 | 63 | 77 | 93 | 125 | 154 | 187 | 233 | 316 | 380 | 475 |
| | LD | 4.2 | 7 | 9.6 | 15.2 | 23 | 31 | 45 | 58 | 70.5 | 85 | 114 | 140 | 170 | 212 | 288 | 346 | 432 |
| Overload current rating *3 | SLD | 110% 60 s, 120% 3 s (inverse-time characteristics) at surrounding air temperature 40°C | | | | | | | | | | | | | | | | |
| | LD | 120% 60 s, 150% 3 s (inverse-time characteristics) at surrounding air temperature 50°C | | | | | | | | | | | | | | | | |
| Rated voltage *4 | | Three-phase 200 to 240 V | | | | | | | | | | | | | | | | |
| **Power supply** Rated input AC voltage/frequency | | Three-phase 200 to 240 V 50 Hz/60 Hz | | | | | | | | | | | | | | | | |
| Permissible AC voltage fluctuation | | 170 to 264 V 50 Hz/60 Hz | | | | | | | | | | | | | | | | |
| Permissible frequency fluctuation | | ±5% | | | | | | | | | | | | | | | | |
| Rated input current (A) *5 | SLD | 5.3 | 8.9 | 13.2 | 19.7 | 31.3 | 45.1 | 62.8 | 80.6 | 96.7 | 115 | 151 | 185 | 221 | 269 | 316 | 380 | 475 |
| | LD | 5 | 8.3 | 12.2 | 18.3 | 28.5 | 41.6 | 58.2 | 74.8 | 90.9 | 106 | 139 | 178 | 207 | 255 | 288 | 346 | 432 |
| Power supply capacity (kVA) *6 | SLD | 2 | 3.4 | 5 | 7.5 | 12 | 17 | 24 | 31 | 37 | 44 | 58 | 70 | 84 | 103 | 120 | 145 | 181 |
| | LD | 1.9 | 3.2 | 4.7 | 7 | 11 | 16 | 22 | 29 | 35 | 41 | 53 | 68 | 79 | 97 | 110 | 132 | 165 |
| Protective structure (IEC 60529) *7 | | Enclose type (IP20) | | | | | | | | | | Open type (IP00) | | | | | | |
| Cooling system | | Self-cooling | | Forced air cooling | | | | | | | | | | | | | | |
| Approx. mass (kg) | | 1.9 | 2.1 | 3.0 | 3.0 | 3.0 | 6.3 | 6.3 | 8.3 | 15 | 15 | 15 | 22 | 42 | 42 | 54 | 74 | 74 |

*1 The applicable motor capacity indicated is the maximum capacity applicable for use of the Mitsubishi 4-pole standard motor.
*2 The rated output capacity indicated assumes that the output voltage is 220 V for 200 V class.
*3 The % value of the overload current rating indicated is the ratio of the overload current to the inverter's rated output current. For repeated duty, allow time for the inverter and motor to return to or below the temperatures under 100% load.
*4 The maximum output voltage does not exceed the power supply voltage. The maximum output voltage can be changed within the setting range. However, the maximum point of the voltage waveform at the inverter output side is the power supply voltage multiplied by about $\sqrt{2}$.
*5 The rated input current indicates a value at a rated output voltage. The impedance at the power supply side (including those of the input reactor and cables) affects the rated input current.
*6 The power supply capacity is the value when at the rated output current. It varies by the impedance at the power supply side (including those of the input reactor and cables).
*7 FR-DU08: IP40 (except for the PU connector section)

### ◆ 400 V class

| Model FR-F840-[ ] | | 00023 | 00038 | 00052 | 00083 | 00126 | 00170 | 00250 | 00310 | 00380 | 00470 | 00620 | 00770 | 00930 | 01160 | 01800 | 02160 | 02600 | 03250 | 03610 | 04320 | 04810 | 05470 | 06100 | 06830 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.75K | 1.5K | 2.2K | 3.7K | 5.5K | 7.5K | 11K | 15K | 18.5K | 22K | 30K | 37K | 45K | 55K | 75K | 90K | 110K | 132K | 160K | 185K | 220K | 250K | 280K | 315K |
| **Output** Applicable motor capacity (kW) *1 | SLD | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 | 75/90 | 110 | 132 | 160 | 185 | 220 | 250 | 280 | 315 | 355 |
| | LD | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 | 75 | 90 | 110 | 132 | 160 | 185 | 220 | 250 | 280 | 315 |
| Rated capacity (kVA) *2 | SLD | 1.8 | 2.9 | 4 | 6.3 | 10 | 13 | 19 | 24 | 29 | 36 | 47 | 59 | 71 | 88 | 137 | 165 | 198 | 248 | 275 | 329 | 367 | 417 | 465 | 521 |
| | LD | 1.6 | 2.7 | 3.7 | 5.8 | 8.8 | 12 | 18 | 22 | 27 | 33 | 43 | 53 | 65 | 81 | 110 | 137 | 165 | 198 | 248 | 275 | 329 | 367 | 417 | 465 |
| Rated current (A) | SLD | 2.3 | 3.8 | 5.2 | 8.3 | 12.6 | 17 | 25 | 31 | 38 | 47 | 62 | 77 | 93 | 116 | 180 | 216 | 260 | 325 | 361 | 432 | 481 | 547 | 610 | 683 |
| | LD | 2.1 | 3.5 | 4.8 | 7.6 | 11.5 | 16 | 23 | 29 | 35 | 43 | 57 | 70 | 85 | 106 | 144 | 180 | 216 | 260 | 325 | 361 | 432 | 481 | 547 | 610 |
| Overload current rating *3 | SLD | 110% 60 s, 120% 3 s (inverse-time characteristics) at surrounding air temperature 40°C | | | | | | | | | | | | | | | | | | | | | | | |
| | LD | 120% 60 s, 150% 3 s (inverse-time characteristics) at surrounding air temperature 50°C | | | | | | | | | | | | | | | | | | | | | | | |
| Rated voltage *4 | | Three-phase 380 to 500 V | | | | | | | | | | | | | | | | | | | | | | | |
| **Power supply** Rated input AC voltage/frequency | | Three-phase 380 to 500 V 50 Hz/60 Hz *8 | | | | | | | | | | | | | | | | | | | | | | | |
| Permissible AC voltage fluctuation | | 323 to 550 V 50 Hz/60 Hz | | | | | | | | | | | | | | | | | | | | | | | |
| Permissible frequency fluctuation | | ±5% | | | | | | | | | | | | | | | | | | | | | | | |
| Rated input current (A) *5 | SLD | 3.2 | 5.4 | 7.8 | 10.9 | 16.4 | 22.5 | 31.7 | 40.3 | 48.2 | 58.4 | 76.8 | 97.6 | 115 | 141 | 180 | 216 | 260 | 325 | 361 | 432 | 481 | 547 | 610 | 683 |
| | LD | 3 | 4.9 | 7.3 | 10.1 | 15.1 | 22.3 | 31 | 38.2 | 44.9 | 53.9 | 75.1 | 89.7 | 106 | 130 | 144 | 180 | 216 | 260 | 325 | 361 | 432 | 481 | 547 | 610 |
| Power supply capacity (kVA) *6 | SLD | 2.5 | 4.1 | 5.9 | 8.3 | 12 | 17 | 24 | 31 | 37 | 44 | 59 | 74 | 88 | 107 | 137 | 165 | 198 | 248 | 275 | 329 | 367 | 417 | 465 | 521 |
| | LD | 2.3 | 3.7 | 5.5 | 7.7 | 12 | 17 | 24 | 29 | 34 | 41 | 57 | 68 | 81 | 99 | 110 | 137 | 165 | 198 | 248 | 275 | 329 | 367 | 417 | 465 |
| Protective structure (IEC 60529) *7 | | Enclose type (IP20) | | | | | | | | | | | | | Open type (IP00) | | | | | | | | | | |
| Cooling system | | Self-cooling | | | Forced air cooling | | | | | | | | | | | | | | | | | | | | |
| Approx. mass (kg) | | 2.5 | 2.5 | 2.5 | 3.0 | 3.0 | 6.3 | 6.3 | 8.3 | 8.3 | 15 | 15 | 23 | 41 | 41 | 43 | 52 | 55 | 71 | 78 | 117 | 117 | 166 | 166 | 166 |

*1 The applicable motor capacity indicated is the maximum capacity applicable for use of the Mitsubishi 4-pole standard motor.

*2 The rated output capacity indicated assumes that the output voltage is 440 V for 400 V class.

*3 The % value of the overload current rating indicated is the ratio of the overload current to the inverter's rated output current. For repeated duty, allow time for the inverter and motor to return to or below the temperatures under 100% load.

*4 The maximum output voltage does not exceed the power supply voltage. The maximum output voltage can be changed within the setting range. However, the maximum point of the voltage waveform at the inverter output side is the power supply voltage multiplied by about $\sqrt{2}$.

*5 The rated input current indicates a value at a rated output voltage. The impedance at the power supply side (including those of the input reactor and cables) affects the rated input current.

*6 The power supply capacity is the value when at the rated output current. It varies by the impedance at the power supply side (including those of the input reactor and cables).

*7 FR-DU08: IP40 (except for the PU connector section)

*8 For the power voltage exceeding 480 V, set **Pr.977 Input voltage mode selection**.

## ● Rating (separated converter type)

### ◆ 400 V class

• Inverter

| Model FR-F842-[ ] | | 07700 | 08660 | 09620 | 10940 | 12120 |
|---|---|---|---|---|---|---|
| | | 355K | 400K | 450K | 500K | 560K |
| Applicable motor capacity (kW) *1 | SLD | 400 | 450 | 500 | 560 | 630 |
| | LD | 355 | 400 | 450 | 500 | 560 |
| Output — Rated capacity (kVA) *2 | SLD | 587 | 660 | 733 | 834 | 924 |
| | LD | 521 | 587 | 660 | 733 | 834 |
| Output — Rated current (A) | SLD | 770 | 866 | 962 | 1094 | 1212 |
| | LD | 683 | 770 | 866 | 962 | 1094 |
| Output — Overload current rating *3 | SLD | 110% 60 s, 120% 3 s (inverse-time characteristics) at surrounding air temperature 40°C | | | | |
| | LD | 120% 60 s, 150% 3 s (inverse-time characteristics) at surrounding air temperature 50°C | | | | |
| Output — Rated voltage *4 | | Three-phase 380 to 500 V | | | | |
| Output — Regenerative braking torque *5 (When the converter unit (FR-CC2) is used) | Maximum brake torque | 10% torque/continuous | | | | |
| Input power — DC power supply voltage | | 430 to 780 VDC | | | | |
| Input power — Control power supply auxiliary input | | Single phase 380 to 500 V 50 Hz/60 Hz *7 | | | | |
| Input power — Permissible control power supply auxiliary input fluctuation | | Frequency ±5%, voltage ±10% | | | | |
| Protective structure (IEC 60529) *6 | | Open type (IP00) | | | | |
| Cooling system | | Forced air cooling | | | | |
| Approx. mass (kg) | | 163 | 163 | 243 | 243 | 243 |

*1 The applicable motor capacity indicated is the maximum capacity applicable for use of the Mitsubishi 4-pole standard motor.
*2 The rated output capacity indicated assumes that the output voltage is 440 V.
*3 The % value of the overload current rating indicated is the ratio of the overload current to the inverter's rated output current. For repeated duty, allow time for the inverter and motor to return to or below the temperatures under 100% load.
*4 The maximum output voltage does not exceed the power supply voltage. The maximum output voltage can be changed within the setting range. However, the maximum point of the voltage waveform at the inverter output side is the power supply voltage multiplied by about $\sqrt{2}$.
*5 LD rating reference value
*6 FR-DU08: IP40 (except for the PU connector section)
*7 For the power voltage exceeding 480 V, set **Pr.977 Input voltage mode selection**.

• Converter unit (FR-CC2)

| Model FR-CC2-H[ ] | | 355K | 400K | 450K | 500K | 560K | 630K |
|---|---|---|---|---|---|---|---|
| Applicable motor capacity (kW) | | 355 | 400 | 450 | 500 | 560 | 630 |
| Output — Overload current rating *1 | | 150% 60 s, 200% 3 s | | | | 120% 60 s, 150% 3 s | 110% 60 s, 120% 3 s |
| Output — Rated voltage *2 | | 430 to 780 VDC *4 | | | | | |
| Power supply — Rated input AC voltage/frequency | | Three-phase 380 to 500 V 50 Hz/60 Hz | | | | | |
| Power supply — Permissible AC voltage fluctuation | | Three-phase 323 to 550 V 50 Hz/60 Hz | | | | | |
| Power supply — Permissible frequency fluctuation | | ±5% | | | | | |
| Power supply — Rated input current (A) | | 683 | 770 | 866 | 962 | 1094 | 1212 |
| Power supply — Power supply capacity (kVA) *3 | | 521 | 587 | 660 | 733 | 833 | 924 |
| Protective structure (IEC 60529) | | Open type (IP00) | | | | | |
| Cooling system | | Forced air cooling | | | | | |
| DC reactor | | Built-in | | | | | |
| Approx. mass (kg) | | 213 | 282 | 285 | 288 | 293 | 294 |

*1 The % value of the overload current rating indicated is the ratio of the overload current to the inverter's rated output current. For repeated duty, allow time for the converter unit and the inverter to return to or below the temperatures under 100% load.
*2 The converter unit output voltage varies according to the input power supply voltage and the load. The maximum point of the voltage waveform at the converter unit output side is approximately the power supply voltage multiplied by $\sqrt{2}$.
*3 The power supply capacity is the value when at the rated output current. It varies by the impedance at the power supply side (including those of the input reactor and cables).
*4 The permissible voltage imbalance ratio is 3% or less. (Imbalance ratio = (highest voltage between lines - average voltage between three lines ) / average voltage between three lines × 100)

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PLC Function
FR Configurator2

Connection Examples

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Terminal Connection Diagrams
Terminal Specs

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Operation Steps

Parameter List

Protective Functions
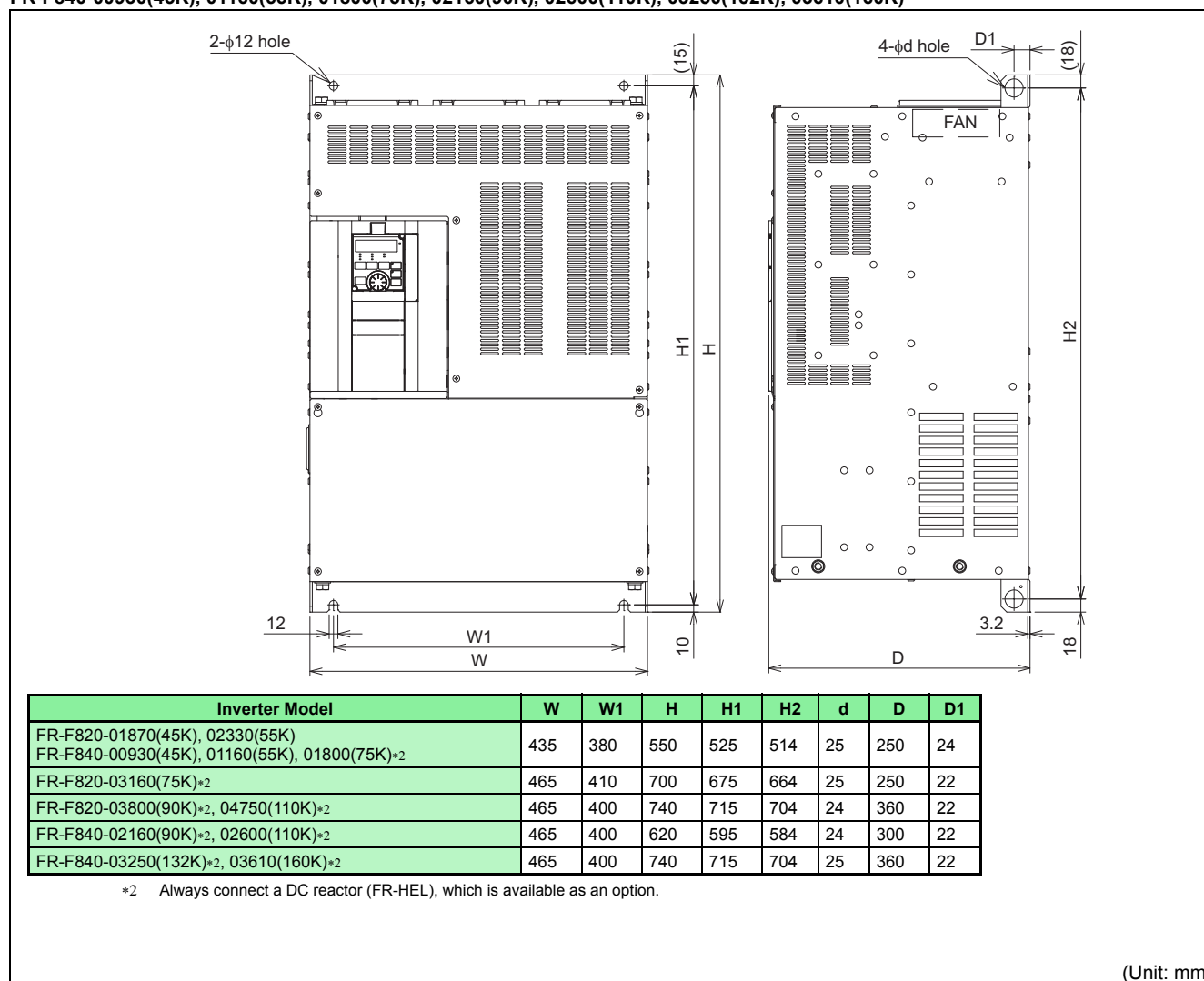
Options

LVS/Cables
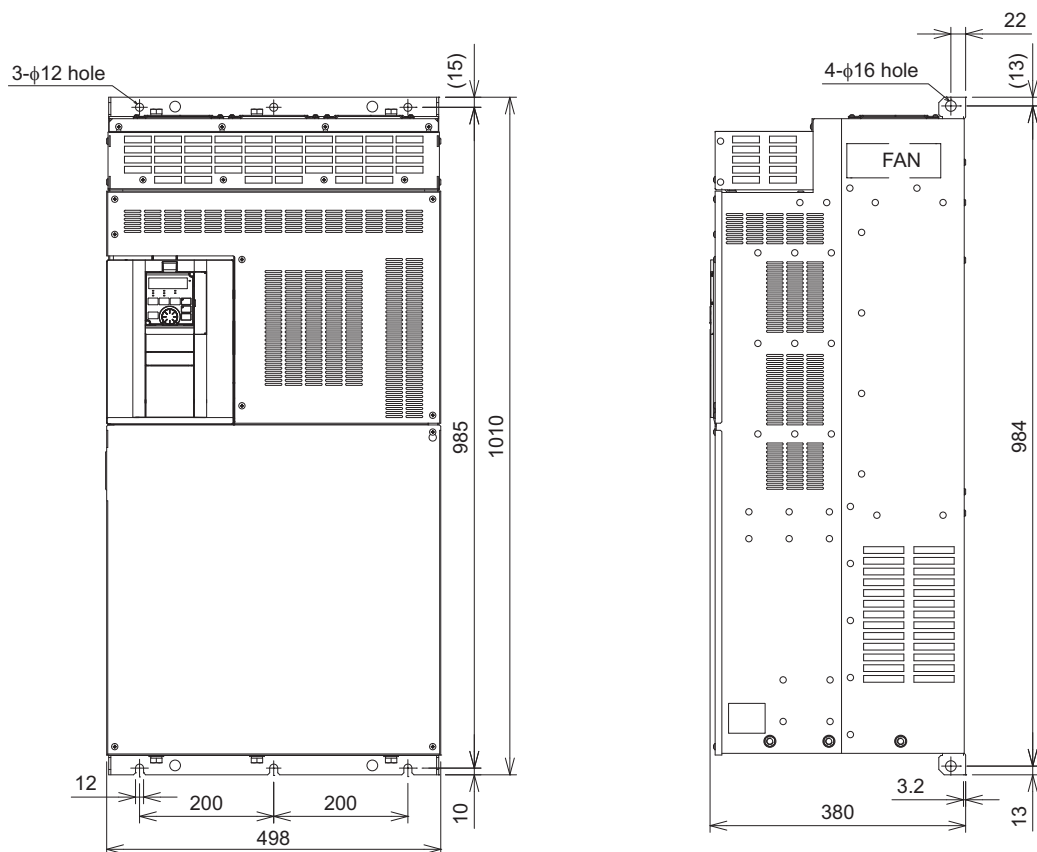
Precautions
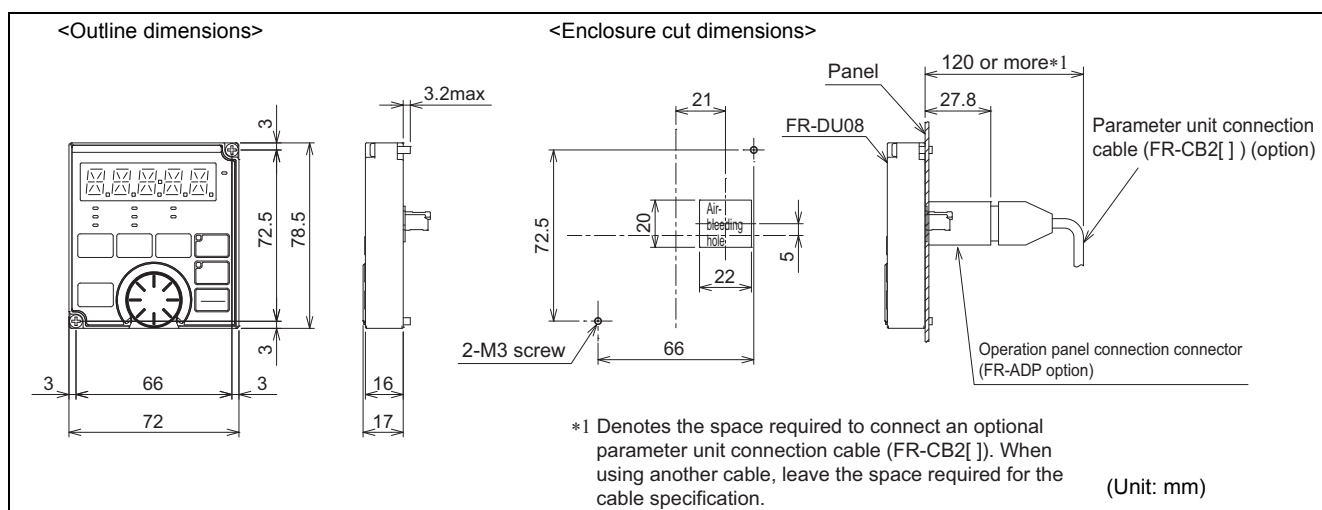
Motors

Compatibility

Warranty
Inquiry

## ● Common specifications

| | | | |
|---|---|---|---|
| **Control specifications** | **Control method** | | Soft-PWM control, high carrier frequency PWM control (selectable among V/F control (Optimum excitation control), Advanced magnetic flux vector control (Advanced optimum excitation control) and PM motor control) |
| | **Output frequency range** | | 0.2 to 590 Hz (The upper-limit frequency is 400 Hz under Advanced magnetic flux vector control, and PM motor control.) |
| | **Frequency setting resolution** | **Analog input** | 0.015 Hz/60 Hz (terminal 2, 4: 0 to 10 V/12 bits)<br>0.03 Hz/60 Hz (0 to 5 V/11 bits or 0 to 20 mA/approx. 11 bits for terminals 2 and 4, 0 to ±10 V/12 bits for terminal 1)<br>0.06 Hz/60 Hz (0 to ±5 V/11 bits for terminal 1) |
| | | **Digital input** | 0.01 Hz |
| | **Frequency accuracy** | **Analog input** | Within ±0.2% of the max. output frequency (25°C ±10°C) |
| | | **Digital input** | Within 0.01% of the set output frequency |
| | **Voltage/frequency characteristics** | | Base frequency can be set from 0 to 590 Hz. Constant-torque/variable-torque pattern or adjustable 5 points V/F can be selected. |
| | **Starting torque** | **Induction motor** | 120% 0.5 Hz (Advanced magnetic flux vector control) |
| | | **IPM motor** | 50% |
| | **Torque boost** | | Manual torque boost |
| | **Acceleration/deceleration time setting** | | 0 to 3600 s (acceleration and deceleration can be set individually), linear or S-pattern acceleration/deceleration mode, backlash countermeasures acceleration/deceleration can be selected. |
| | **DC injection brake (induction motor)** | | Operation frequency (0 to 120 Hz), operation time (0 to 10 s), operation voltage (0 to 30%) variable |
| | **Stall prevention operation level** | | Activation range of stall prevention operation (SLD rating: 0 to 120%, LD rating: 0 to 150%). Whether to use the stall prevention or not can be selected. (V/F control, Advanced magnetic flux vector control) |
| **Operation specifications** | **Frequency setting signal** | **Analog input** | Terminals 2 and 4: 0 to 10 V, 0 to 5 V, 4 to 20 mA (0 to 20 mA) are available.<br>Terminal 1: -10 to +10 V, -5 to 5 V are available. |
| | | **Digital input** | Input using the setting dial of the operation panel or the parameter unit<br>Four-digit BCD or 16-bit binary (when used with option FR-A8AX) |
| | **Start signal** | | Forward and reverse rotation or start signal automatic self-holding input (3-wire input) can be selected. |
| | **Input signals (twelve terminals)** | | Low-speed operation command, Middle-speed operation command, High-speed operation command, Second function selection, Terminal 4 input selection, Jog operation selection, Output stop, Start self-holding selection, Forward rotation command, Reverse rotation command, Inverter reset<br>The input signal can be changed using **Pr.178 to Pr.189 (input terminal function selection)**. |
| | | **Pulse train input** | 100 kpps |
| | **Operational functions** | | Maximum and minimum frequency settings, multi-speed operation, acceleration/deceleration pattern, thermal protection, DC injection brake, starting frequency, JOG operation, output stop (MRS), stall prevention, regeneration avoidance, increased magnetic excitation deceleration, DC feeding[*1], frequency jump, rotation display, automatic restart after instantaneous power failure, electronic bypass sequence, remote setting, retry function, carrier frequency selection, fast-response current limit, forward/reverse rotation prevention, operation mode selection, slip compensation, speed smoothing control, traverse, auto tuning, applied motor selection, RS-485 communication, PID control, PID pre-charge function, cooling fan operation selection, stop selection (deceleration stop/coasting), power-failure deceleration stop function, PLC function, life diagnosis, maintenance timer, current average monitor, multiple rating, test run, 24 V power supply input for control circuit, safety stop function, self power management, BACnet communication, PID gain tuning, cleaning, load characteristics storage, emergency drive[*1] |
| | **Output signal** | **Open collector output (five terminals)**<br>**Relay output (two terminals)** | Inverter running, Up to frequency, Instantaneous power failure/undervoltage[*1], Overload warning, Output frequency detection, Fault<br>The output signal can be changed using **Pr.190 to Pr.196 (output terminal function selection)**.<br>Fault codes of the inverter can be output (4 bits) from the open collector. |
| | | **Pulse train output (FM type)** | 50 kpps |
| **Indication** | **For meter** | **Pulse train output (FM type)** | Max. 2.4 kHz: one terminal (output frequency)<br>The monitored item can be changed using **Pr.54 FM/CA terminal function selection**. |
| | | **Current output (CA type)** | Max. 20 mADC: one terminal (output current)<br>The monitored item can be changed using **Pr.54 FM/CA terminal function selection**. |
| | | **Voltage output** | Max. 10 VDC: one terminal (output voltage)<br>The monitored item can be changed using **Pr.158 AM terminal function selection**. |
| | **Operation panel (FR-DU08)** | **Operating status** | Output frequency, output current, output voltage, frequency setting value<br>The monitored item can be changed using **Pr.52 Operation panel main monitor selection**. |
| | | **Fault record** | Fault record is displayed when a fault occurs. Past 8 fault records and the conditions immediately before the fault (output voltage/current/frequency/cumulative energization time/year/month/date/time) are saved. |
| **Protective/ warning function** | **Protective function** | | Overcurrent trip during acceleration, Overcurrent trip during constant speed, Overcurrent trip during deceleration or stop, Regenerative overvoltage trip during acceleration, Regenerative overvoltage trip during constant speed, Regenerative overvoltage trip during deceleration or stop, Inverter overload trip (electronic thermal relay function), Motor overload trip (electronic thermal relay function), Heatsink overheat, Instantaneous power failure[*1], Undervoltage[*1], Input phase loss[*1][*2], Stall prevention stop, Loss of synchronism detection[*2], Upper limit fault detection, Lower limit fault detection, Output side earth (ground) fault overcurrent, Output short circuit, Output phase loss, External thermal relay operation[*2], PTC thermistor operation[*2], Option fault, Communication option fault, Parameter storage device fault, PU disconnection, Retry count excess[*2], CPU fault, Operation panel power supply short circuit/RS-485 terminals power supply short circuit, 24 VDC power fault, Abnormal output current detection[*2], Inrush current limit circuit fault[*1], Communication fault (inverter), Analog input fault, USB communication fault, Safety circuit fault, Overspeed occurrence[*2], 4 mA input fault[*2], Pre-charge fault[*2], PID signal fault[*2], Internal circuit fault, User definition error in the PLC function |
| | **Warning function** | | Fan alarm, Stall prevention (overcurrent), Stall prevention (overvoltage), Electronic thermal relay function pre-alarm, PU stop, Parameter copy, Safety stop, Maintenance timer 1 to 3[*2], USB host error, Operation panel lock[*2], Password locked[*2], Parameter write error, Copy operation error, 24 V external power supply operation, Load fault warning, Emergency drive in operation[*1] |
| **Environment** | **Surrounding air temperature** | | -10°C to +50°C (non-freezing) (LD rating)<br>-10°C to +40°C (non-freezing) (SLD rating) |
| | **Surrounding air humidity** | | With circuit board coating (conforming to IEC60721-3-3 3C2/3S2): 95% RH or less (non-condensing)<br>Without circuit board coating: 90% RH or less (non-condensing) |
| | **Storage temperature[*3]** | | -20°C to +65°C |
| | **Atmosphere** | | Indoors (without corrosive gas, flammable gas, oil mist, dust and dirt, etc.) |
| | **Altitude/vibration** | | Maximum 1000 m above sea level[*4], 5.9 m/s$^2$ or less[*5] at 10 to 55 Hz (directions of X, Y, Z axes) |

*1   Available only for the standard model.
*2   This protective function is not available in the initial status.
*3   Temperature applicable for a short time, e.g. in transit.
*4   For the installation at an altitude above 1,000 m (up to 2,500 m), derate the rated current 3% per 500 m.
*5   2.9 m/s$^2$ or less for the FR-F840-04320(185K) or higher.

## ● PLC function specifications

| Item | | | F800 PLC function specifications |
|---|---|---|---|
| Control method | | | Repeated operation (by stored program) |
| I/O control mode | | | Refresh |
| Programming language | | | Relay symbolic language (ladder)<br>Function block |
| No. of instructions | Sequence instructions | | 25 |
| | Basic instructions | | 84 |
| | Application instructions | | 37 |
| Processing speed | | | Sequence instructions 1.9 µs to 12 µs/step*1 |
| Number of I/O device points | | | 128 (input: 64 points, output: 64 points)<br>19 points built-in (input: 12 points, output: 7 points)*2<br>FR-A8AX (input: 16 points)<br>FR-A8AY (output: 7 points)<br>FR-A8AR (output: 3 points) |
| Number of analog I/O points | | | 3 input points built-in (Terminals 1, 2, and 4)<br>2 output points built-in (Terminals FM/CA and AM), FR-A8AY: 2 output points (AM0 and AM1) |
| Pulse train I/O | Input | | Terminal JOG maximum input pulse: 100k pulses/s *3 |
| | Output | | Terminal FM maximum output pulse: 50k pulses/s *3 |
| Watchdog timer | | | 10 to 2000 ms |
| Program capacity | | | 6K steps (24K bytes) (0 to 6144 steps can be set)<br>Contained in one program |
| Device | Internal relay (M) | | 128 (M0 to M127) |
| | Latch relay (L) | | Not used (Can be set with parameters but will not latch)*4 |
| | Timer (T) | Number of points | 16 (T0 to T15) |
| | | Specifications | 100 ms timer: 0.1 to 3276.7 s can be set<br>10 ms timer: 0.01 to 327.67 s can be set<br>100 ms retentive timer: 0.1 to 3276.7 s can be set |
| | Counter (C) | Number of points | 16 (C0 to C15) |
| | | Specifications | Normal counter: Setting range 1 to 32767<br>Interrupt program counter: Not used |
| | Data register (D) | | 256 (D0 to D255) |
| | Special relay (SM) | | 2048 (SM0 to SM2047) with limited functions |
| | Special register (SD) | | 2048 (SD0 to SD2047) with limited functions |

*1   The scan time is approximately 40 ms for 1K steps as inverter control is also performed in actual operations.
*2   The signals same as the ones assigned to the inverter I/O terminals are used.
      One point is always required for a sequence start (RUN/STOP).
*3   **Pr.291 Pulse train I/O selection** must be set.
*4   There is no device latch function for power failures.
      Use the **Pr.1150 to Pr.1199 PLC function user parameters 1 to 50** (D206 to D255) to store device values in the EEPROM.

┈┈┈ **NOTE** ┈┈┈
   • There is no buffer memory.

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# ✤ Outline Dimension Drawings

● **Standard model**

**FR-F820-00046(0.75K), FR-F820-00077(1.5K)**



| Inverter Model | D | D1 |
|---|---|---|
| FR-F820-00046(0.75K) | 110 | 20 |
| FR-F820-00077(1.5K) | 125 | 35 |
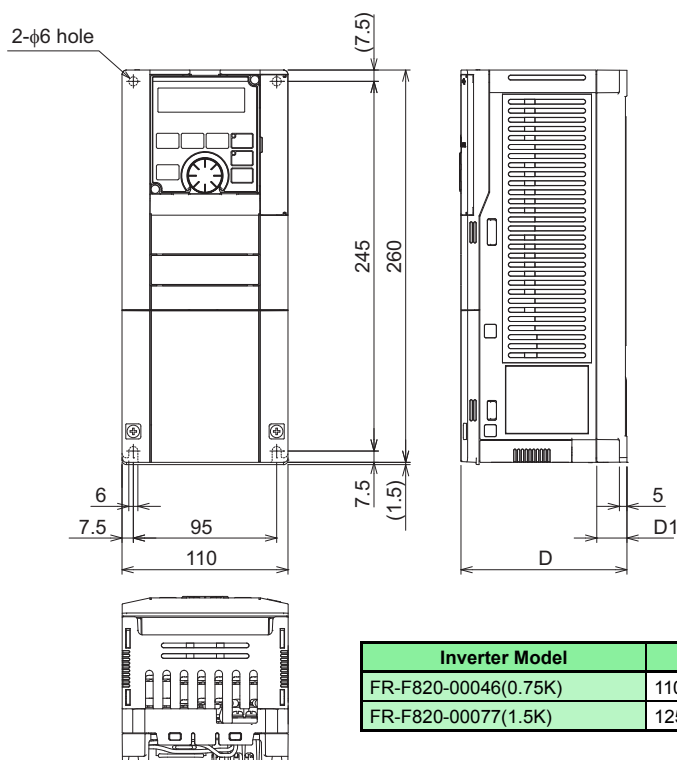
(Unit: mm)

**FR-F820-00105(2.2K), 00167(3.7K), 00250(5.5K)**
**FR-F840-00023(0.75K), 00038(1.5K), 00052(2.2K), 00083(3.7K), 00126(5.5K)**



∗1 FR-F840-00023(0.75K) to 00052(2.2K) are not provided with a cooling fan.
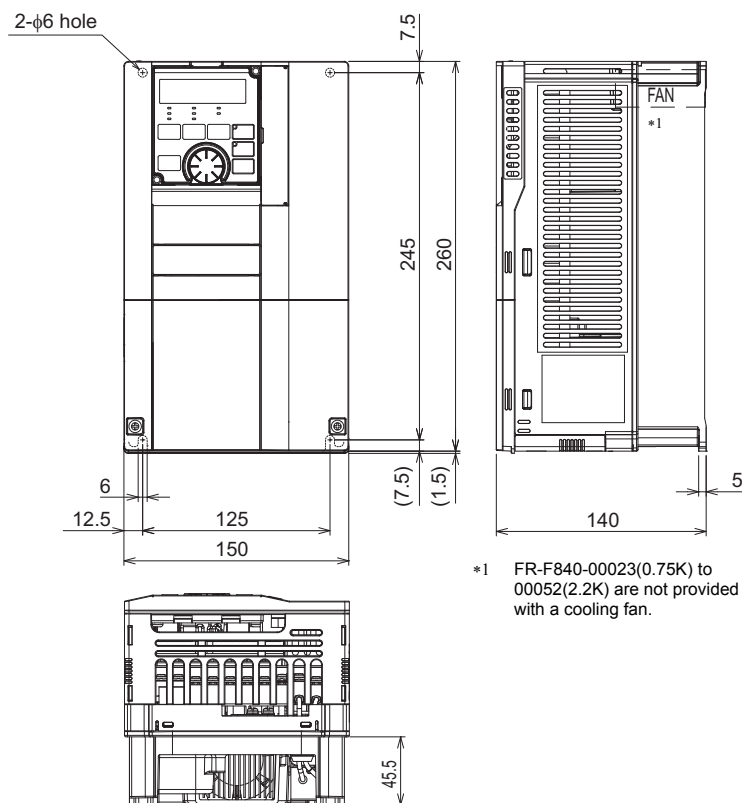
(Unit: mm)

**FR-F820-00340(7.5K), 00490(11K), 00630(15K)**
**FR-F840-00170(7.5K), 00250(11K), 00310(15K), 00380(18.5K)**



| Inverter Model | H | H1 | H2 | D | D1 |
|---|---|---|---|---|---|
| FR-F820-00340(7.5K), 00490(11K)<br>FR-F840-00170(7.5K), 00250(11K) | 260 | 245 | 1.5 | 170 | 84 |
| FR-F820-00630(15K)<br>FR-F840-00310(15K), 00380(18.5K) | 300 | 285 | 3 | 190 | 101.5 |
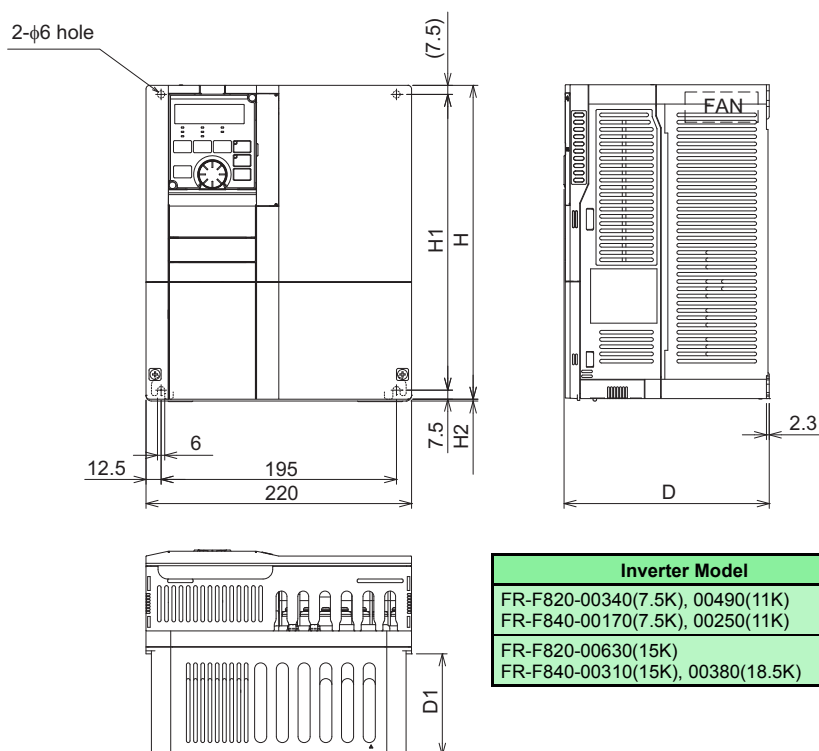
(Unit: mm)

**FR-F820-00770(18.5K), 00930(22K), 01250(30K)**
**FR-F840-00470(22K), 00620(30K)**
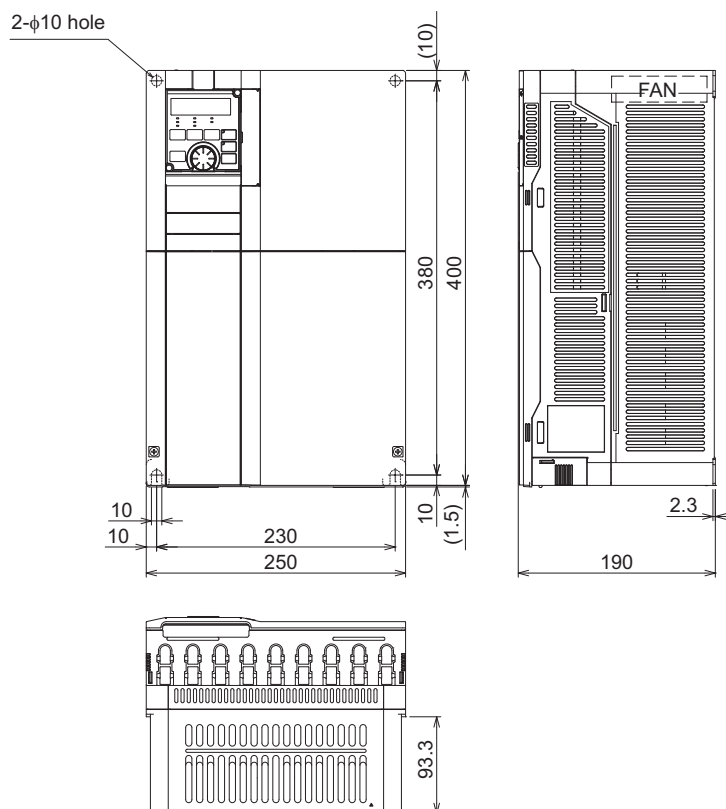


(Unit: mm)

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**FR-F820-01540(37K)**
**FR-F840-00770(37K)**
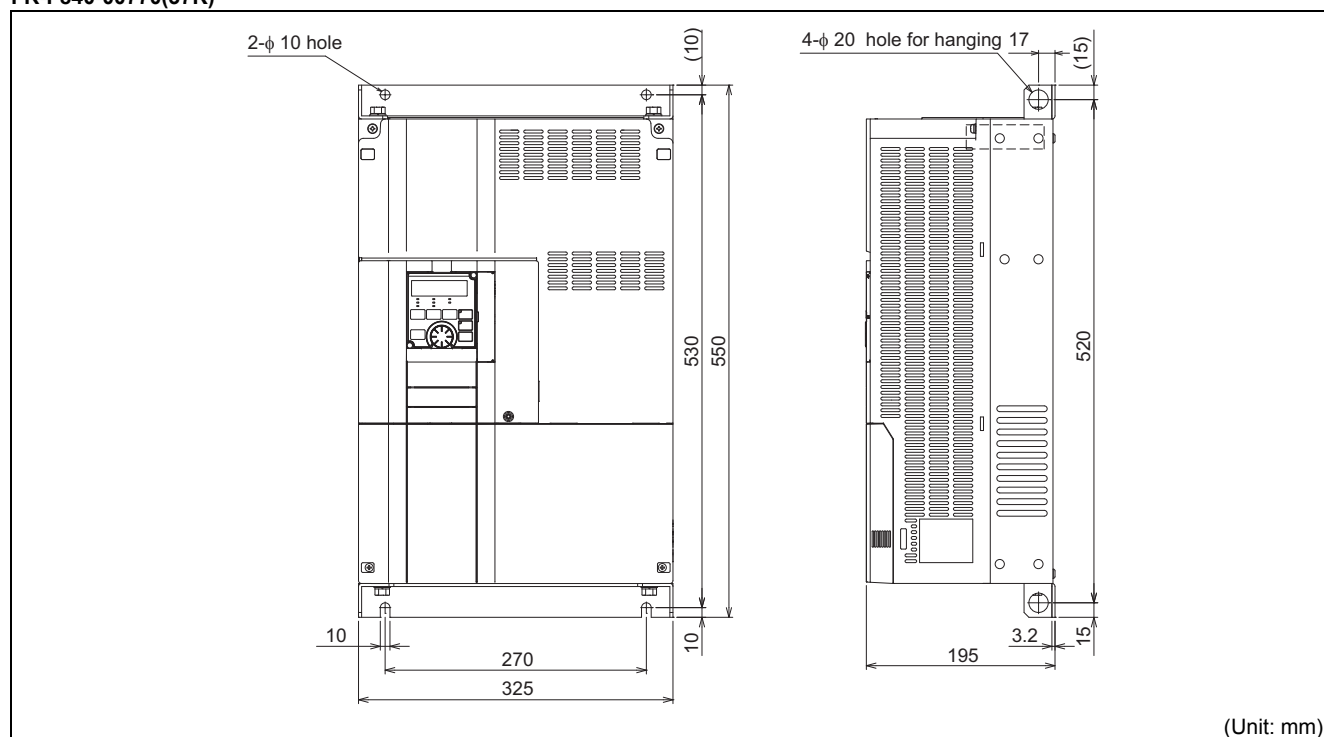


(Unit: mm)

**FR-F820-01870(45K), 02330(55K), 03160(75K), 03800(90K), 04750(110K)**
**FR-F840-00930(45K), 01160(55K), 01800(75K), 02160(90K), 02600(110K), 03250(132K), 03610(160K)**



| Inverter Model | W | W1 | H | H1 | H2 | d | D | D1 |
|---|---|---|---|---|---|---|---|---|
| FR-F820-01870(45K), 02330(55K)<br>FR-F840-00930(45K), 01160(55K), 01800(75K)∗2 | 435 | 380 | 550 | 525 | 514 | 25 | 250 | 24 |
| FR-F820-03160(75K)∗2 | 465 | 410 | 700 | 675 | 664 | 25 | 250 | 22 |
| FR-F820-03800(90K)∗2, 04750(110K)∗2 | 465 | 400 | 740 | 715 | 704 | 24 | 360 | 22 |
| FR-F840-02160(90K)∗2, 02600(110K)∗2 | 465 | 400 | 620 | 595 | 584 | 24 | 300 | 22 |
| FR-F840-03250(132K)∗2, 03610(160K)∗2 | 465 | 400 | 740 | 715 | 704 | 25 | 360 | 22 |

∗2  Always connect a DC reactor (FR-HEL), which is available as an option.

(Unit: mm)

**FR-F840-04320(185K), 04810(220K)**



3-φ12 hole · 4-φ16 hole · FAN

Always connect a DC reactor (FR-HEL), which is available as an option. (Unit: mm)

**FR-F840-05470(250K), 06100(280K), 06830(315K)**



3-φ12 hole · 4-φ16 hole · FAN

Always connect a DC reactor (FR-HEL), which is available as an option. (Unit: mm)

## ● Separated converter type

◆ **Inverter**

**FR-F842-07700(355K), 08660(400K)**



3-φ12 hole
(15)
8-φ25 hole
185
23
(17)
1300
1330
1296
12
70  200  200  (70)
15
540
4.5  4.5
185
440
17
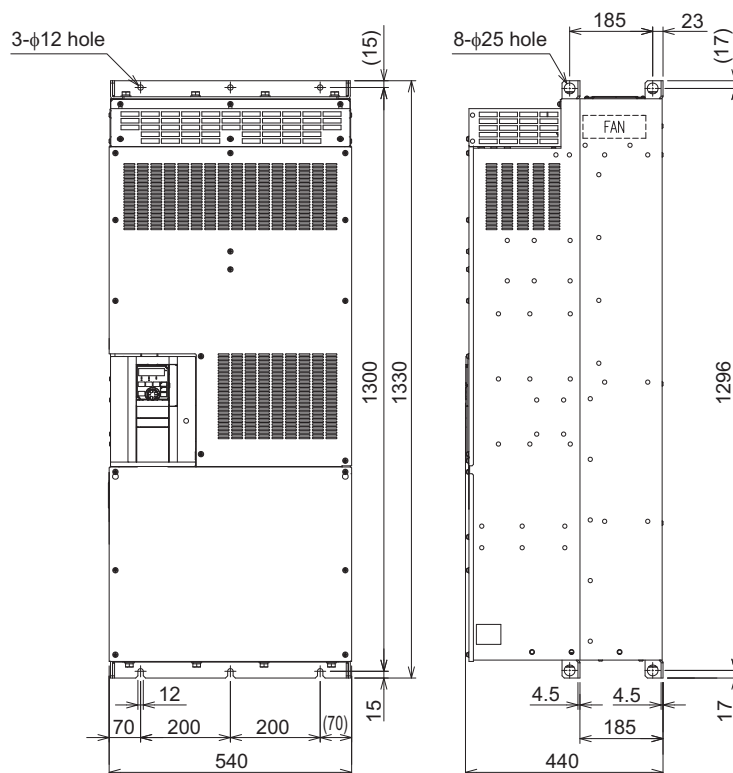
(Unit: mm)

**FR-F842-09620(450K), 10940(500K), 12120(560K)**



3-φ12 hole
(15)
8-φ25 hole
185
23
(17)
1550
1580
1546
12
100  240  240  (100)
15
680
4.5  4.5
185
440
17
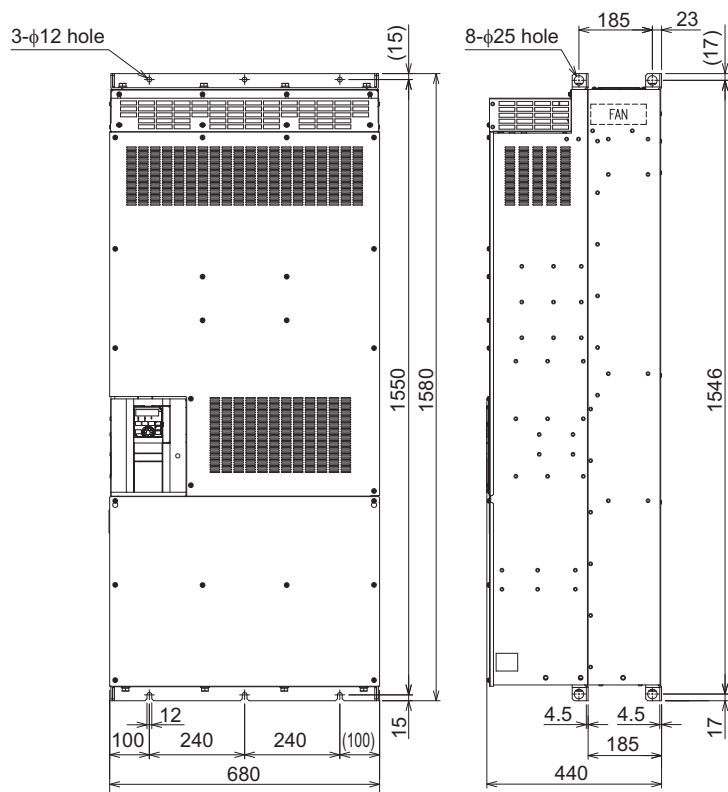
(Unit: mm)

## ◆ Converter unit

### FR-CC2-H355K



3-φ12 hole
8-φ25 hole
185  23
(15)  (17)
1300  1330  1296
12
15
100  200  200  (100)
600
4.5  4.5
185
17
440

Equipped with a DC reactor.

(Unit: mm)
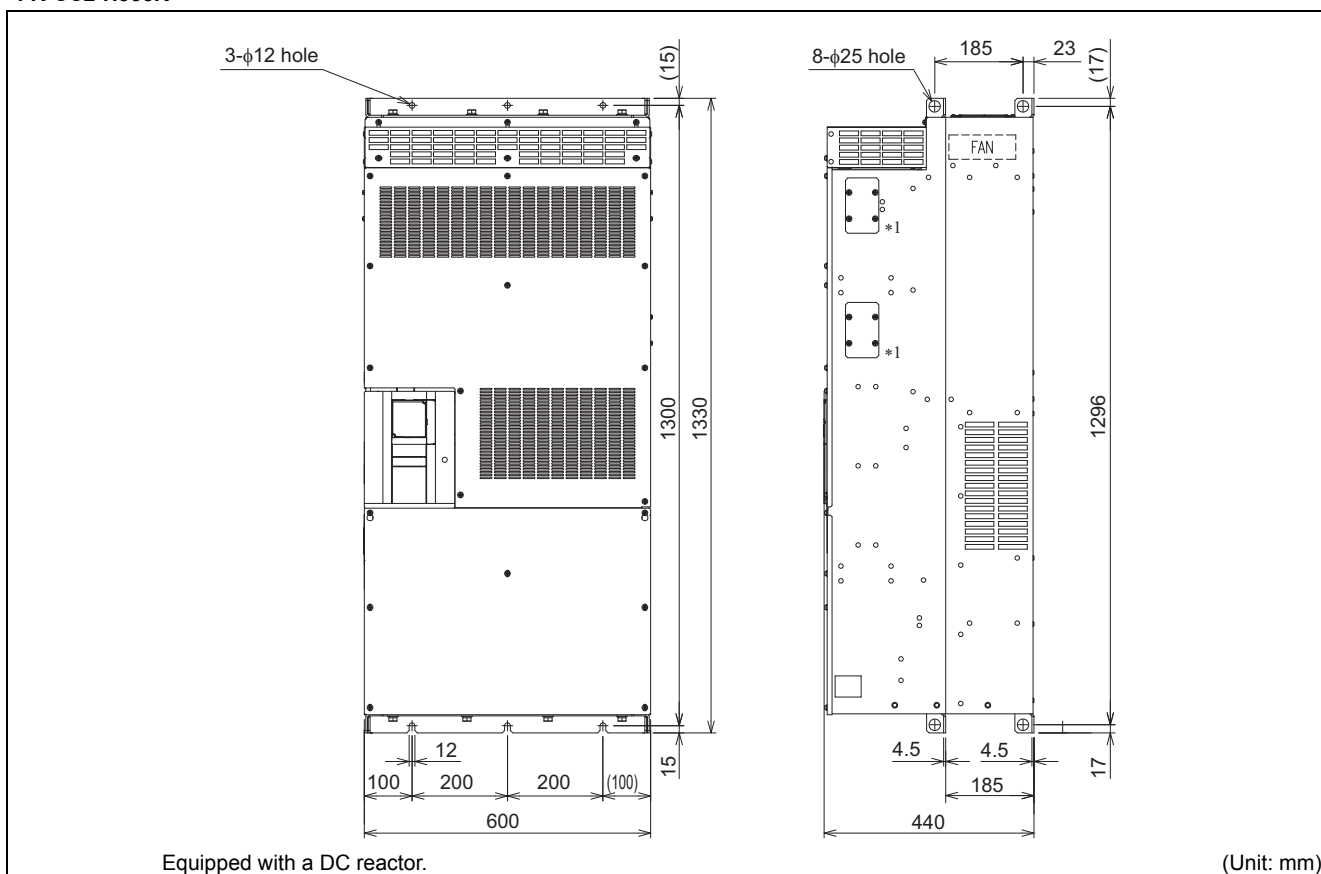
### FR-CC2-H400K, H450K, H500K, H560K, H630K



3-φ12 hole
8-φ25 hole
185  23
(15)  (17)
1550  1580  1546
12
15
100  200  200  (100)
600
4.5  4.5
185
17
440

Equipped with a DC reactor.

(Unit: mm)
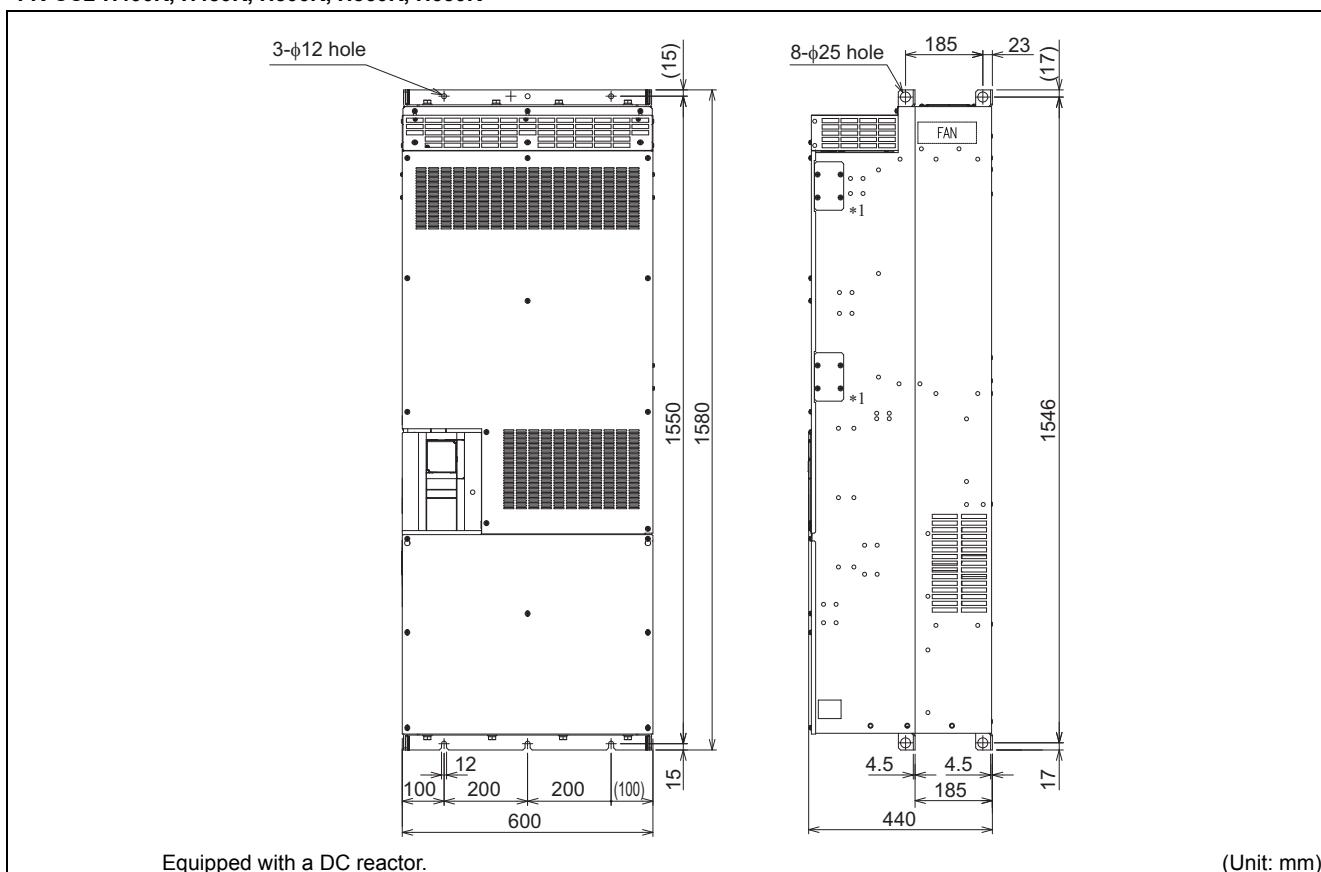
*1    Do not remove the cover on the side of the converter unit.

## ● Operation panel (FR-DU08)



&lt;Outline dimensions&gt;

&lt;Enclosure cut dimensions&gt;

Panel

120 or more∗1

27.8

FR-DU08

3.2max

3
72.5
78.5
3

3  66  3

72

16

17

21

72.5

20

Air-bleeding hole

22

5

66

2-M3 screw

Parameter unit connection cable (FR-CB2[ ] ) (option)

Operation panel connection connector (FR-ADP option)

∗1 Denotes the space required to connect an optional parameter unit connection cable (FR-CB2[ ]). When using another cable, leave the space required for the cable specification.

(Unit: mm)

## ● Heatsink protrusion attachment procedure

When encasing the inverter or the converter unit in an enclosure, the heat generated in the enclosure can be greatly reduced by protruding the heatsink of the inverter or the converter unit. When installing the inverter in a compact enclosure, etc., this installation method is recommended. For the FR-F840-04320(185K) or higher, a heatsink can be protruded outside the enclosure without using an attachment.

### ◆ When using a heatsink protrusion attachment (FR-A8CN)

For the FR-F820-00105(2.2K) to FR-F820-04750(110K) and FR-F840-00023(0.75K) to FR-F840-03610(160K), a heatsink can be protruded outside the enclosure using a heatsink protrusion attachment (FR-A8CN). Refer to the instruction manual of the heatsink protrusion attachment (FR-A8CN) for details.

• Drawing after attachment installation (when used with the FR-A8CN)
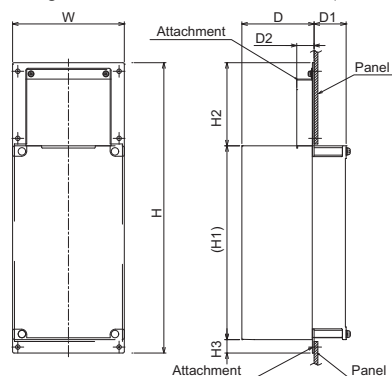
| Type | W | H | H1 | H2 | H3 | D | D1 | D2 |
|---|---|---|---|---|---|---|---|---|
| FR-A8CN01 | 150 | 389.5 | 260 | 111.5 | 18 | 97 | 43 | 24.3 |
| FR-A8CN02 | 245 | 408.5 | 260 | 116.5 | 32 | 86 | 84 | 21.3 |
| FR-A8CN03 | 245 | 448.5 | 300 | 116.5 | 32 | 89 | 101 | 21.3 |
| FR-A8CN04 | 280 | 554 | 400 | 113.5 | 32 | 96.7 | 93.3 | 40.6 |
| FR-A8CN05 | 357 | 654 | 480 | 130 | 44 | 130.8 | 64.2 | 105 |
| FR-A8CN06 | 478.2 | 650 | 465 | 145 | 40 | 96 | 154 | 55 |
| FR-A8CN07 | 510.2 | 805 | 610 | 150 | 45 | 130 | 120 | 105 |
| FR-A8CN08 | 510.2 | 845 | 650 | 150 | 45 | 176.5 | 183.5 | 40 |
| FR-A8CN09 | 510.2 | 725 | 530 | 150 | 45 | 152.3 | 147.7 | 65 |

(Unit: mm)

• Enclosure cut dimensions (when used with the FR-A8CN)
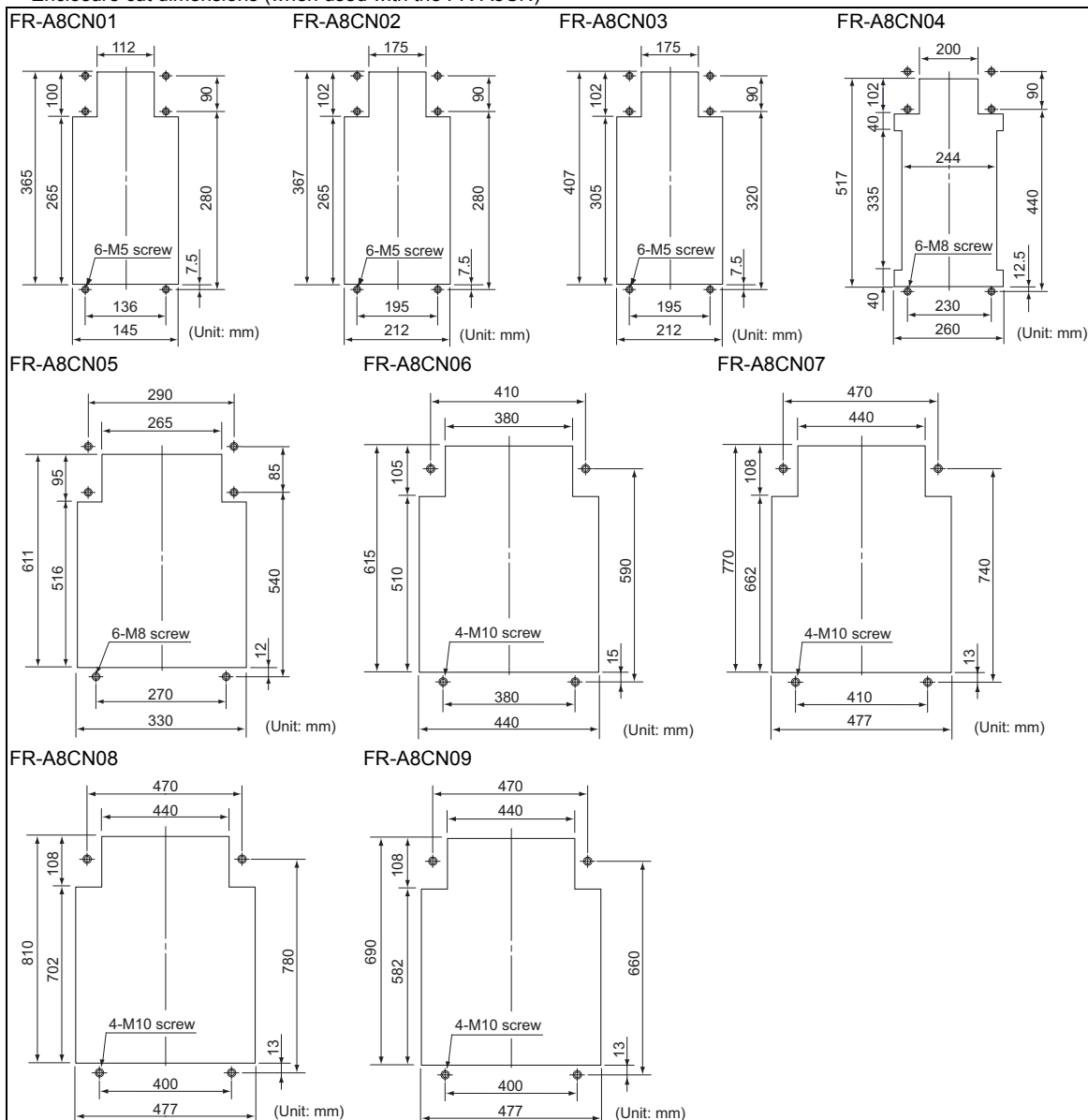
For a compatibility table between the attachment and the inverter, refer to **page 80**.

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## ◆ Heatsink protrusion for the FR-F840-04320(185K) or higher

· Enclosure cutting
  Cut an enclosure according to the capacity of the inverter or the converter unit.

| FR-F840-04320(185K) | FR-F840-05470(250K) | FR-F842-07700(355K) | FR-F842-09620(450K) |
|---|---|---|---|
| FR-F840-04810(220K) | FR-F840-06100(280K) | FR-F842-08660(400K) | FR-F842-10940(500K) |
|  | FR-F840-06830(315K) |  | FR-F842-12120(560K) |

FR-CC2-H355K

FR-CC2-H400K
FR-CC2-H450K
FR-CC2-H500K
FR-CC2-H560K
FR-CC2-H630K

(Unit: mm)
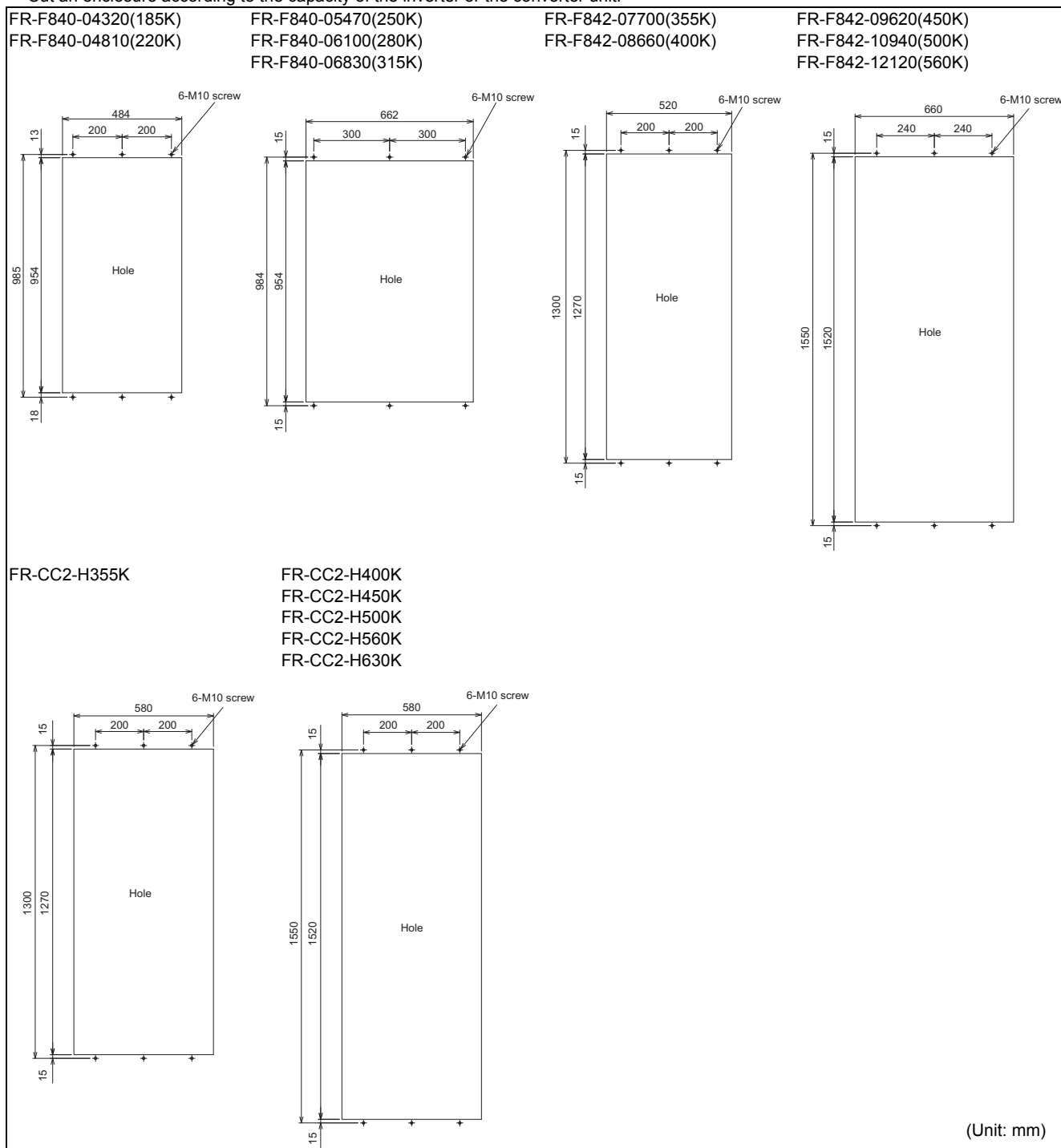
- Shift and removal of a rear side installation frame

For the FR-F840-04320(185K) to FR-F840-06830(315K)

One installation frame is attached to each of the upper and lower parts of the inverter. Change the position of the rear side installation frame on the upper and lower sides of the inverter to the front side as shown below. When changing the installation frames, make sure that the installation orientation is correct.
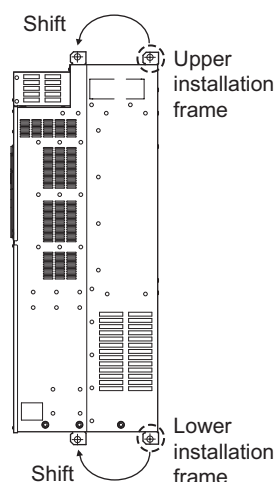
For the FR-F842-07700(355K) to FR-F842-12120(560K), FR-CC2-H355K to FR-CC2-H630K

Two installation frames are attached to each of the upper and lower parts of the inverter or the converter unit. Remove the rear side installation frame on the upper and lower sides of the inverter or the converter unit as shown below.

Shift

Upper installation frame

Lower installation frame

Shift

Removal

Upper installation frame (rear side)

Lower installation frame (rear side)

Removal
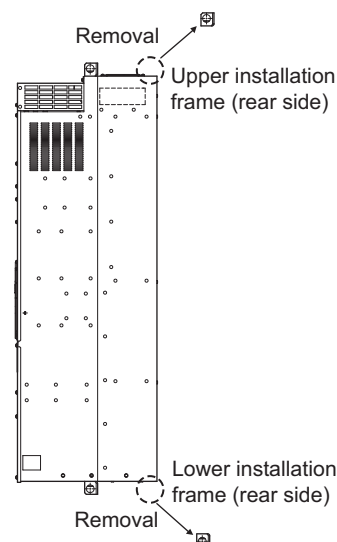
- Installation of the inverter or the converter unit
  Push the inverter heatsink portion outside the enclosure and fix the enclosure and the inverter or the converter unit with upper and lower installation frame.

Enclosure

Inside the enclosure

Exhausted air

Inverter/ Converter unit

Installation frame

Cooling wind

185mm

Dimension of the outside of the enclosure

There are finger guards behind the enclosure. Therefore, the thickness of the panel should be less than 10 mm (∗1) and also do not place anything around finger guards to avoid contact with the finger guards.

Enclosure

Finger guard

10mm∗1

140mm

6mm

**NOTE**

- Having a cooling fan, the cooling section which comes out of the enclosure cannot be used in the environment of water drops, oil, mist, dust, etc.
- Be careful not to drop screws, dust etc. into the inverter or the converter unit  and the cooling fan section.
- The FR-A7CN heatsink protrusion attachment cannot be installed on the FR-F800 series.

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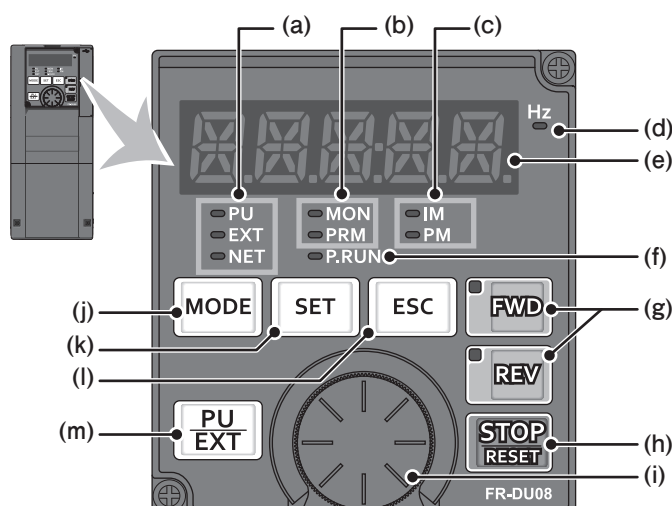Motors

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## ● Standard models

### ◆ FM type



Sink logic
◎ Main circuit terminal
○ Control circuit terminal

DC reactor (FR-HEL)∗1

Brake unit (Option)

FR-F820-00770(18.5K) to 01250(30K), FR-F840-00470(22K) to 01800(75K)

DC reactor (FR-HEL)∗1

Brake unit (Option)

Earth (Ground)

Jumper

P1  P/+  P3  PR∗7  N/-

Earth (Ground)

Jumper  Jumper

P1  P/+  PX∗7  PR∗7  N/-

MCCB  MC

Three-phase AC power supply

R/L1  S/L2  T/L3

R1/L11  S1/L21

Jumper ∗2

Inrush current limit circuit

EMC filter ON/OFF connecter

Main circuit

ON / OFF

U  V  W

Motor  M

Earth (Ground)

Earth (Ground)

### Control circuit

Control input signals (No voltage input allowed)∗3

Forward rotation start — STF

Reverse rotation start — STR

Start self-holding selection — STP(STOP)

Multi-speed selection
- High speed — RH
- Middle speed — RM
- Low speed — RL

Jog operation — JOG ∗4

Second function selection — RT

Output stop — MRS

Reset — RES

Terminal 4 input selection (Current input selection) — AU

∗12 — CS

Contact input common — SD

24VDC power supply (Common for external power supply transistor) — PC

24V

SOURCE / SINK

Relay output∗8

C1  B1  A1  — Relay output 1 (Fault output)

C2  B2  A2  — Relay output 2

Open collector output∗9

RUN — Running
SU — Up to frequency
IPF — Instantaneous power failure
OL — Overload
FU — Frequency detection
SE — Open collector output common / Sink/source common

24V external power supply input — +24
Common terminal — SD

Frequency setting signals (Analog)

10E(+10V)
10(+5V)

Frequency setting potentiometer 1/2W1kΩ∗6

2
5 (Analog common)

DC0 to 5V Initial value (DC0 to 10V / DC0 to 20mA selectable)∗5

Auxiliary input (+)(-) — 1
DC0 to ±10V Initial value (DC0 to ±5V selectable)∗5

Terminal 4 input (Current input) (+)(-) — 4
DC4 to 20mA Initial value (DC0 to 5V / DC0 to 10V selectable)∗5

∗5 Voltage/current input switch
ON / OFF
2  4

Connector for plug-in option connection

connector 1  connector 2
connector 3

Safety stop signal

Shorting wire  24V

PC
Safety stop input (Channel 1) — S1
Safety stop input (Channel 2) — S2
Safety stop input common — SIC
SD

Output shutoff circuit

PU connector

USB A connector

USB mini B connector

F/C (FM)∗10
SD

AM
5

Calibration resistor ∗11

Indicator (Frequency meter, etc.)
Moving-coil type 1mA full-scale

(+)
(-) Analog signal output (0 to ±10VDC)

TXD+
TXD-
RXD+
RXD-
SG

RS-485 terminals
Data transmission
Data reception
GND

Terminating resistor

VCC — 5V (Permissible load current 100mA)

So — Safety monitor output
SOC — Safety monitor output common

∗1 For the FR-F820-03160(75K) or higher, the FR-F840-01800(75K) or higher, always connect a DC reactor (FR-HEL), which is available as an option. (To select a DC reactor, refer to **page 18**, **page 106**, and select one according to the applicable motor capacity.) When a DC reactor is connected to the FR-F820-02330(55K) or lower or the FR-F840-01160(55K) or lower, if a jumper is installed across the terminals P1 and P/+, remove the jumper before installing the DC reactor.

∗2 When using separate power supply for the control circuit, remove the jumper between R1/L11 and S1/L21.

∗3 The function of these terminals can be changed with the input terminal assignment **(Pr.178 to Pr.189)**.

∗4 Terminal JOG is also used as the pulse train input terminal. Use **Pr.291** to choose JOG or pulse.

∗5 Terminal input specifications can be changed by analog input specification switchover **(Pr.73, Pr.267)**. To input a voltage, set the voltage/current input switch OFF. To input a current, set the voltage/current input switch ON. Terminals 10 and 2 are also used as a PTC input terminal. **(Pr.561)**

∗6 It is recommended to use 2 W 1 kΩ when the frequency setting signal is changed frequently.

∗7 Do not use terminals PR and PX. Do not remove the jumper connected to terminals PR and PX.

∗8 The function of these terminals can be changed with the output terminal assignment **(Pr.195, Pr.196)**.

∗9 The function of these terminals can be changed with the output terminal assignment **(Pr.190 to Pr.194)**.

∗10 The terminal F/C (FM) can be used to output pulse trains as open collector output by setting **Pr.291**.

∗11 Not required when calibrating the scale with the operation panel.

∗12 No function is assigned in the initial status. Assign the function using **Pr.186 CS terminal function selection**.

## ◆ CA type



Source logic
- ⊙ Main circuit terminal
- ○ Control circuit terminal

DC reactor (FR-HEL)∗1

Brake unit (Option)

Earth (Ground)

Jumper    Jumper

P1    P/+    PX∗7    PR∗7    N/-

FR-F820-00770(18.5K) to 01250(30K),
FR-F840-00470(22K) to 01800(75K)

DC reactor (FR-HEL)∗1

Brake unit (Option)

Earth (Ground)    Jumper

P1    P/+    P3    PR∗7    N/-

MCCB    MC

Three-phase AC power supply

R/L1
S/L2
T/L3

R1/L11
S1/L21

Jumper ∗2

Inrush current limit circuit

EMC filter ON/OFF connecter    ON / OFF

Main circuit

U
V
W

Motor    M

Earth (Ground)

Earth (Ground)

### Control circuit

Control input signals (No voltage input allowed)∗3

- Forward rotation start — STF
- Reverse rotation start — STR
- Start self-holding selection — STP(STOP)
- Multi-speed selection
  - High speed — RH
  - Middle speed — RM
  - Low speed — RL
- Jog operation — JOG ∗4
- Second function selection — RT
- Output stop — MRS
- Reset — RES
- Terminal 4 input selection (Current input selection) — AU
- ∗10 — CS
- Common for external power supply transistor — SD
- Contact input common 24VDC power supply — PC

SOURCE    SINK    24V

Relay output∗8

C1
B1
A1    Relay output 1 (Fault output)

C2
B2
A2    Relay output 2

Open collector output∗9

- RUN — Running
- SU — Up to frequency
- IPF — Instantaneous power failure
- OL — Overload
- FU — Frequency detection
- SE — Open collector output common / Sink/source common

24V external power supply input — +24
Common terminal — SD

∗5 Voltage/current input switch    ON / OFF    2  4

Frequency setting signals (Analog)

10E(+10V)
10(+5V)

Frequency setting potentiometer 1/2W1kΩ∗6

2 — DC0 to 5V (DC0 to 10V / DC0 to 20mA Initial value selectable)∗5
5 — (Analog common)

Auxiliary input (+)(-) — 1 — DC0 to ±10V (DC0 to ±5V selectable)∗5

Terminal 4 input (Current input) (+)(-) — 4 — DC4 to 20mA (DC0 to 5V / DC0 to 10V Initial value selectable)∗5

PU connector

USB A connector

USB mini B connector

F/C (CA) — Analog current output (0 to 20mADC) (+)(-)

AM — Analog signal output (DC0 to ±10V) (+)(-)

∇ 5

Connector for plug-in option connection

connector 1    connector 2
connector 3

RS-485 terminals

- TXD+ / TXD- — Data transmission
- RXD+ / RXD- — Data reception
- SG — GND
- VCC — 5V (Permissible load current 100mA)

Terminating resistor

Safety stop signal

Shorting wire    24V

PC
S1 — Safety stop input (Channel 1)
S2 — Safety stop input (Channel 2)
SIC — Safety stop input common
SD

Output shutoff circuit

So — Safety monitor output
SOC — Safety monitor output common

∗1 For the FR-F820-03160(75K) or higher, the FR-F840-01800(75K) or higher, always connect a DC reactor (FR-HEL), which is available as an option. (To select a DC reactor, refer to **page 18**, **page 106**, and select one according to the applicable motor capacity.)
When a DC reactor is connected to the FR-F820-02330(55K) or lower or the FR-F840-01160(55K) or lower, if a jumper is installed across the terminals P1 and P/+, remove the jumper before installing the DC reactor.
∗2 When using separate power supply for the control circuit, remove the jumper between R1/L11 and S1/L21.
∗3 The function of these terminals can be changed with the input terminal assignment **(Pr.178 to Pr.189)**.
∗4 Terminal JOG is also used as the pulse train input terminal. Use **Pr.291** to choose JOG or pulse.
∗5 Terminal input specifications can be changed by analog input specification switchover **(Pr.73, Pr.267)**. To input a voltage, set the voltage/current input switch OFF. To input a current, set the voltage/current input switch ON. Terminals 10 and 2 are also used as a PTC input terminal. **(Pr.561)**
∗6 It is recommended to use 2 W 1 kΩ when the frequency setting signal is changed frequently.
∗7 Do not use terminals PR and PX. Do not remove the jumper connected to terminals PR and PX.
∗8 The function of these terminals can be changed with the output terminal assignment **(Pr.195, Pr.196)**.
∗9 The function of these terminals can be changed with the output terminal assignment **(Pr.190 to Pr.194)**.
∗10 No function is assigned in the initial status. Assign the function using **Pr.186 CS terminal function selection**.

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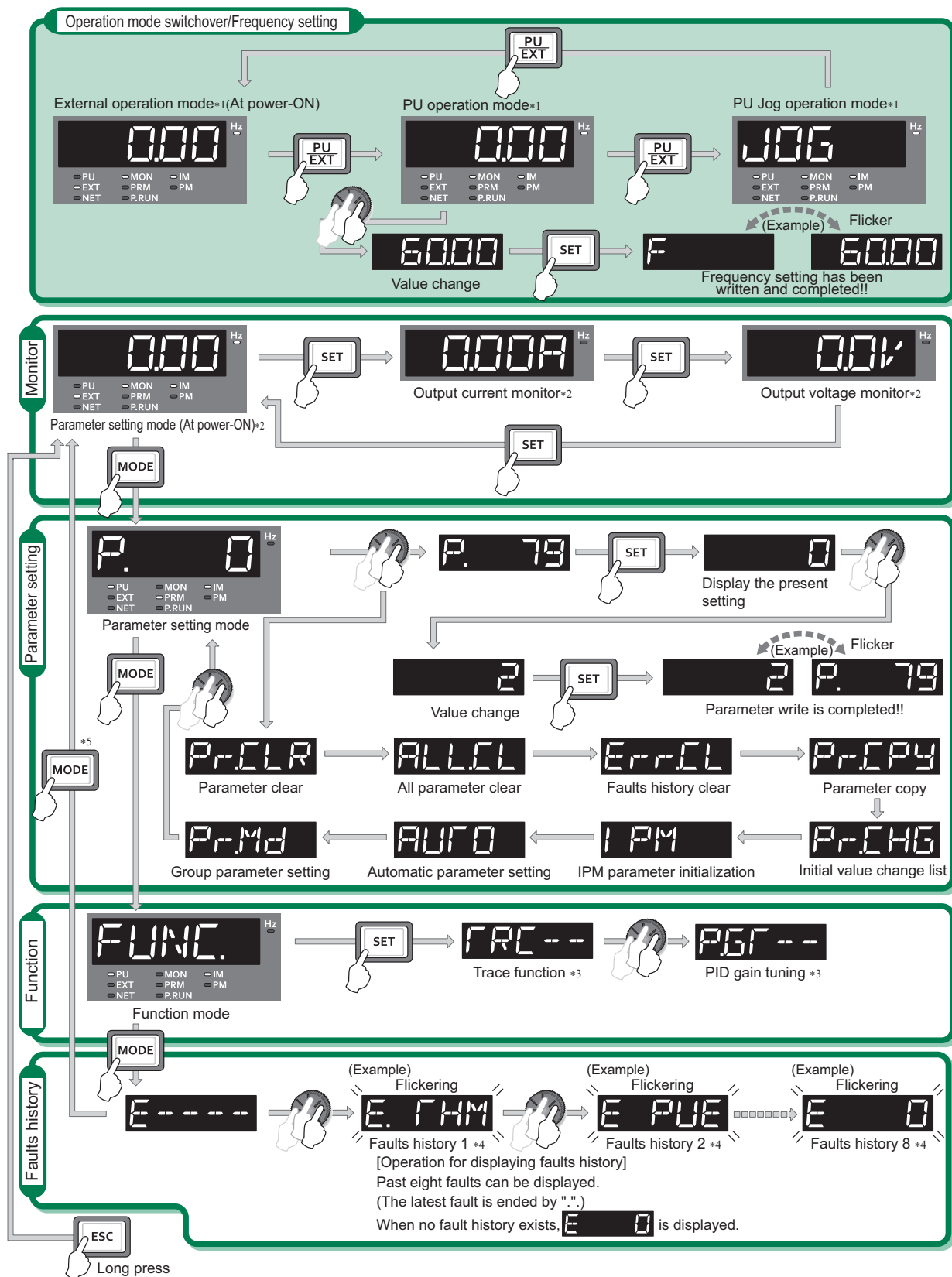Parameter List
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## ● Separated converter type

### ◆ Inverter (FM type)
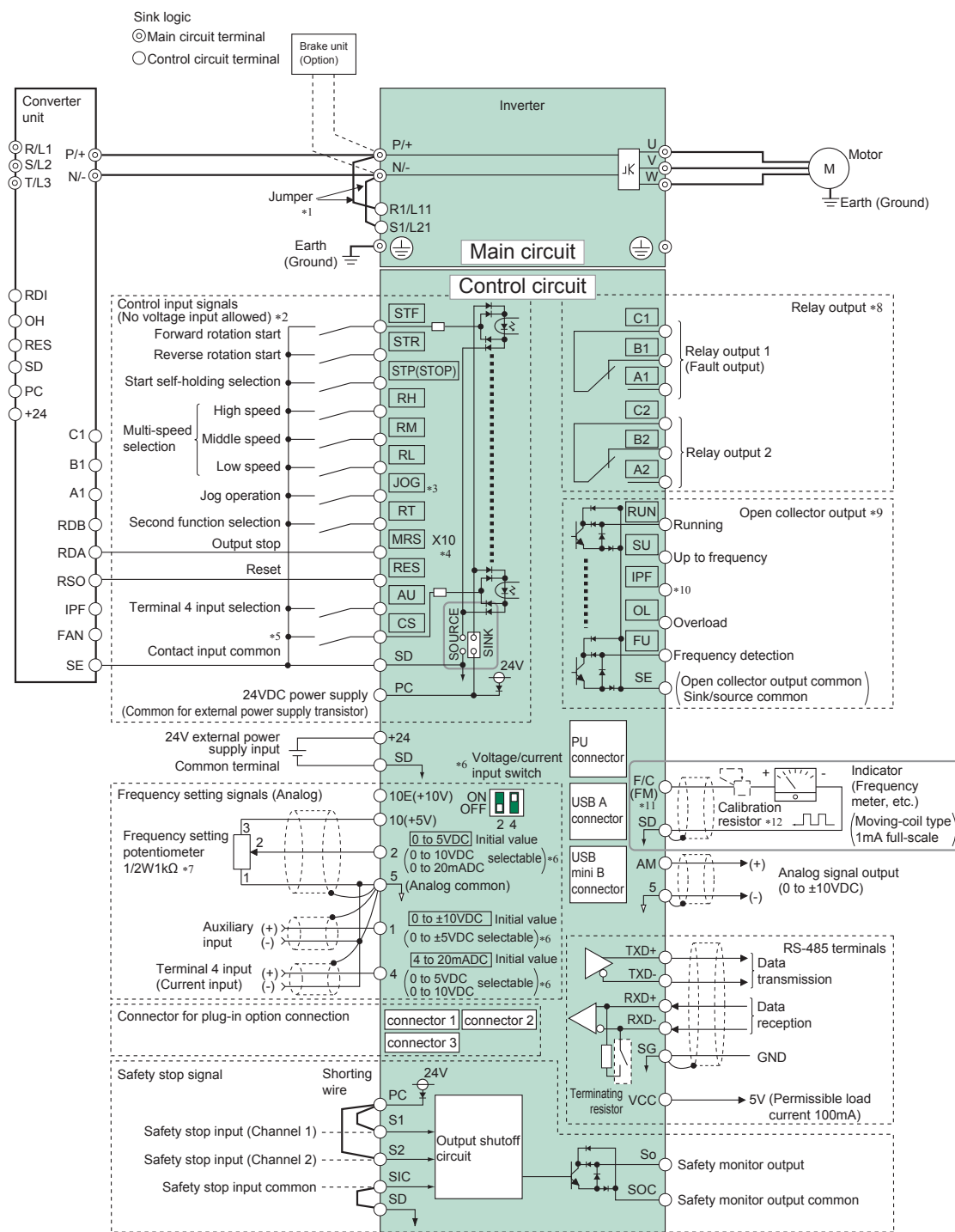


*1   The terminals R1/L11 and S1/L21 are connected to the terminals P/+ and N/- with a jumper respectively. When using separate power supply for the control circuit, remove the jumpers from R1/L11 and S1/L21.

*2   The function of these terminals can be changed with the input terminal assignment **(Pr.178 to Pr.189)**.

*3   Terminal JOG is also used as the pulse train input terminal. Use **Pr.291** to choose JOG or pulse.

*4   The X10 signal (NC contact input specification) is assigned to the terminal MRS in the initial setting. Set **Pr.599** = "0" to change the input specification of the X10 signal to NO contact.

*5   No function is assigned in the initial setting. Use **Pr.186** for function assignment.

*6   Terminal input specifications can be changed by analog input specification switchover **(Pr.73, Pr.267)**. To input a voltage, set the voltage/current input switch OFF. To input a current, set the voltage/current input switch ON. Terminals 10 and 2 are also used as a PTC input terminal. **(Pr.561)**

*7   It is recommended to use 2 W 1 kΩ when the frequency setting signal is changed frequently.

*8   The function of these terminals can be changed with the output terminal assignment **(Pr.195, Pr.196)**.

*9   The function of these terminals can be changed with the output terminal assignment **(Pr.190 to Pr.194).**

*10  No function is assigned in the initial setting. Use **Pr.192** for function assignment.

*11  The terminal F/C (FM) can be used to output pulse trains as open collector output by setting **Pr.291**.

*12  Not required when calibrating the scale with the operation panel.

## ● Converter unit (FR-CC2)

### ◆ When the sink logic is selected



Sink logic
◎ Main circuit terminal
○ Control circuit terminal
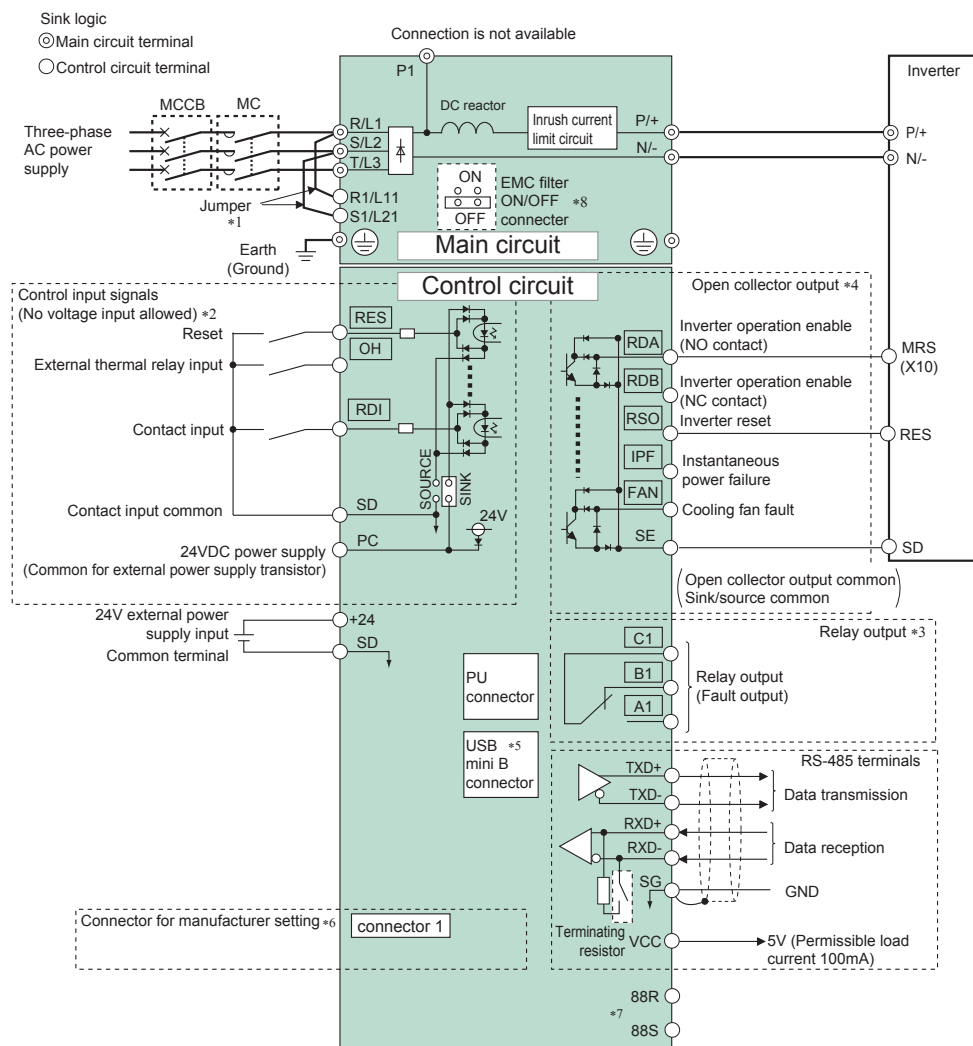
*1 When using separate power supply for the control circuit, remove the jumpers from R1/L11 and S1/L21.
*2 The function of these terminals can be changed with the input terminal assignment **(Pr.178, Pr.187, Pr.189)**.
*3 The function of these terminals can be changed with the output terminal assignment **(Pr.195)**.
*4 The function of these terminals can be changed with the output terminal assignment **(Pr.190 to Pr.194).**
*5 The connector is for manufacturer setting. Do not use.
*6 Plug-in options cannot be used.
*7 For manufacturer setting. Do not use.
*8 For the FR-CC2-H400K to H630K, two EMC filter ON/OFF connectors are provided.

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# ✵ Terminal Specification Explanation

## ● Standard models, and separated converter type

indicates that terminal functions can be selected from **Pr.178 to Pr.196 (I/O terminal function selection)**.
Terminal names and terminal functions are those of the factory set.

| Type | | Terminal Symbol | Terminal Name | Description | |
|---|---|---|---|---|---|
| **Main circuit** | | R/L1, S/L2, T/L3 *1 | AC power input | Connect to the commercial power supply. | |
| | | U, V, W | Inverter output | Connect a three-phase squirrel-cage motor or PM motor. | |
| | | R1/L11, S1/L21 | Power supply for control circuit | Connected to the AC power supply terminals R/L1 and S/L2. To retain alarm display and alarm output, apply external power to this terminal. | |
| | | P/+, N/- P3, N/- *1 *2 | Brake unit connection | Connect the brake unit (FR-BU2), power regeneration common converter (FR-CV), power regeneration converter (MT-RC), high power factor converter (FR-HC2), or DC power supply (under DC feeding mode). Connect the separated converter type to the terminals P/+ and N/- of the converter unit. | |
| | | P/+, P1 *1 | DC reactor connection | Remove the jumper across terminals P/+-P1 and connect a DC reactor. For the FR-F820-03160(75K) or higher, the FR-F840-01800(75K) or higher, always connect a DC reactor, which is available as an option. | |
| | | PR, PX *1 | | Do not use terminals PX and PR. The terminal PX is equipped in the FR-F820-00490(11K) or lower and the FR-F840-00250(11K) or lower. The terminal PR is equipped in the FR-F820-01250(30K) or lower and the FR-F840-01800(75K) or lower. | |
| | | ⏚ | Earth (Ground) | For earthing (grounding) the inverter chassis. Must be earthed (grounded). | |
| **Control circuit/input signal** | **Contact input** | STF | Forward rotation start | Turn ON the STF signal to start forward rotation and turn it OFF to stop. | When the STF and STR signals are turned ON simultaneously, the stop command is given. |
| | | STR | Reverse rotation start | Turn ON the STR signal to start reverse rotation and turn it OFF to stop. | |
| | | STP (STOP) | Start self-holding selection | Turn ON the STOP signal to self-hold the start signal. | |
| | | RH, RM, RL | Multi-speed selection | Multi-speed can be selected according to the combination of RH, RM and RL signals. | |
| | | JOG | Jog mode selection | Turn ON the JOG signal to select Jog operation (initial setting) and turn ON the start signal (STF or STR) to start Jog operation. | |
| | | | Pulse train input | JOG terminal can be used as pulse train input terminal. To use as pulse train input terminal, the **Pr.291** setting needs to be changed. (maximum input pulse: 100k pulses/s) | |
| | | RT | Second function selection | Turn ON the RT signal to select second function selection. When the second function such as "Second torque boost" and "Second V/F (base frequency)" are set, turning ON the RT signal selects these functions. | |
| | | MRS | Output stop | Turn ON the MRS signal (2 ms or more) to stop the inverter output. Use to shut OFF the inverter output when stopping the motor by electromagnetic brake. | |
| | | MRS (X10) *7 | Output stop (Inverter operation enable) | Connect to the terminal RDA of the converter unit (FR-CC2). When the RDA signal is turned OFF, the inverter output is shut off. The X10 signal (NC contact) is assigned to the terminal MRS in the initial setting. Use **Pr.599** to change the specification to NO contact. | |
| | | RES | Reset | Used to reset alarm output provided when protective circuit is activated. Turn ON the RES signal for more than 0.1 s, then turn it OFF. Recover about 1 s after reset is cancelled. | |
| | | AU | Terminal 4 input selection | Terminal 4 is made valid only when the AU signal is turned ON. Turning the AU signal ON makes terminal 2 invalid. | |
| | | CS | No function | Use **Pr.186 CS terminal function selection** for function assignment. | |
| | | SD | Contact input common (sink) *3 | Common terminal for the contact input terminal (sink logic) and terminal FM. | |
| | | | External transistor common (source) *4 | Connect this terminal to the power supply common terminal of a transistor output (open collector output) device, such as a programmable controller, in the source logic to avoid malfunction by undesirable current. | |
| | | | 24 VDC power supply common | Common output terminal for the 24 VDC 0.1 A power supply (terminal PC). Isolated from terminals 5 and SE. | |
| | | PC | External transistor common (sink) *3 | Connect this terminal to the power supply common terminal of a transistor output (open collector output) device, such as a programmable controller, in the sink logic to avoid malfunction by undesirable currents. | |
| | | | Contact input common (source) *4 | Common terminal for contact input terminal (source logic). | |
| | | | 24 VDC power supply | Can be used as 24 VDC 0.1 A power supply. | |
| | **Frequency setting** | 10E | Frequency setting power supply | When connecting a frequency setting potentiometer at an initial status, connect it to terminal 10. Change the input specifications of terminal 2 when connecting it to terminal 10E. | 10 VDC, permissible load current 10 mA |
| | | 10 | | | 5 VDC, permissible load current 10 mA |
| | | 2 | Frequency setting (voltage) | Inputting 0 to 5 VDC (or 0 to 10 V, 4 to 20 mA) provides the maximum output frequency at 5 V (10 V, 20 mA) and makes input and output proportional. Use **Pr.73** to switch from among input 0 to 5 VDC (initial setting), 0 to 10 VDC, and 4 to 20 mA. Set the voltage/current input switch in the ON position to select current input (0 to 20 mA). | Voltage input: Input resistance 10 k$\Omega$ $\pm$ 1 k$\Omega$ Maximum permissible voltage 20 VDC Current input: Input resistance 245 $\Omega$ $\pm$ 5 $\Omega$ Maximum permissible current 30 mA |
| | | 4 | Frequency setting (current) | Inputting 4 to 20 mADC (or 0 to 5 V, 0 to 10 V) provides the maximum output frequency at 20 mA and makes input and output proportional. This input signal is valid only when the AU signal is on (terminal 2 input is invalid). Use **Pr.267** to switch from among input 4 to 20 mA (initial setting), 0 to 5 VDC, and 0 to 10 VDC. Set the voltage/current input switch in the OFF position to select voltage input (0 to 5 V/0 to 10 V). Use **Pr.858** to switch terminal functions. | |
| | | 1 | Frequency setting auxiliary | Inputting 0 to ±5 VDC or 0 to ±10 VDC adds this signal to terminal 2 or 4 frequency setting signal. Use **Pr.73** to switch between input 0 to ±5 VDC and 0 to ±10 VDC (initial setting) input. | Input resistance 10 k$\Omega$ ±1 k$\Omega$ Maximum permissible voltage ±20 VDC |
| | | 5 | Frequency setting common | Common terminal for frequency setting signal (terminal 2, 1 or 4) and analog output terminal AM, CA. Do not earth (ground). | |
| | **Thermistor** | 10 2 | PTC thermistor input | For receiving PTC thermistor outputs. When PTC thermistor is valid (**Pr.561** ≠ "9999"), the terminal 2 is not available for frequency setting. | Applicable PTC thermistor specification Overheat detection resistance:500 $\Omega$ to 30 k$\Omega$ (Set by **Pr.561**) |
| | **Power supply input** | +24 | 24 V external power supply input | For connecting 24 V external power supply. If the 24 V external power supply is connected, power is supplied to the control circuit while the main power circuit is OFF. | Input voltage 23 to 25.5 VDC Input current 1.4 A or less |

| Type | | Terminal Symbol | Terminal Name | Description | |
|------|------|------|------|------|------|
| Control circuit/output signal | Relay | A1, B1, C1 | Relay output 1 (alarm output) | 1 changeover contact output indicates that the inverter protective function has activated and the output stopped. Alarm: discontinuity across B-C (continuity across A-C), Normal: continuity across B-C (discontinuity across A-C) | Contact capacity 230 VAC 0.3 A (power factor =0.4) 30 VDC 0.3 A |
| | | A2, B2, C2 | Relay output 2 | 1 changeover contact output | |
| | Open collector | RUN | Inverter running | Switched low when the inverter output frequency is equal to or higher than the starting frequency (initial value 0.5 Hz). Switched high during stop or DC injection brake operation. | Permissible load 24 VDC (maximum 27 VDC) 0.1 A (A voltage drop is 2.8 V at maximum while the signal is ON.) LOW is when the open collector output transistor is ON (conducted).HIGH is when the transistor is OFF (not conducted). |
| | | SU | Up to frequency | Switched low when the output frequency reaches within the range of ±10% (initial value) of the set frequency. Switched high during acceleration/ deceleration and at a stop. | |
| | | OL | Overload alarm | Switched low when stall prevention is activated by the stall prevention function. Switched high when stall prevention is cancelled. | Alarm code (4 bits) output |
| | | IPF | Instantaneous power failure | Switched low when an instantaneous power failure and under voltage protections are activated. | |
| | | IPF *7 | Open collector output | No function is assigned in the initial setting. The function can be assigned setting Pr.192. | |
| | | FU | Frequency detection | Switched low when the inverter output frequency is equal to or higher than the preset detected frequency and high when less than the preset detected frequency. | |
| | | SE | Open collector output common | Common terminal for terminals RUN, SU, OL, IPF, FU | |
| | Pulse | FM *5 | For meter | Select one e.g. output frequency from monitor items. (The signal is not output during an inverter reset.) The output signal is proportional to the magnitude of the corresponding monitoring item. The output signal is proportional to the magnitude of the corresponding monitoring item.Use Pr.55, Pr.56, and Pr.866 to set full scales for the monitored output frequency, output current, and torque. | Output item: output frequency (initial setting), permissible load current 2 mA, For full scale1440 pulses/s |
| | | | NPN open collector output | | Signals can be output from the open collector terminals by setting Pr.291. (maximum output pulse: 50kpulses/s) |
| | Analog | AM | Analog voltage output | | Output item: output frequency (initial setting), output signal 0 to ±10 VDC, permissible load current 1 mA (load impedance 10 kΩ or more), resolution 8 bits |
| | | CA *6 | Analog current output | | Output item: output frequency (initial setting), Load impedance 200 Ω to 450 Ω Output signal 0 to 20 mADC |
| Communication | | — | PU connector | With the PU connector, communication can be made through RS-485. (1:1 connection only) • Conforming standard: EIA-485(RS-485)   • Communication speed: 4800 to 115200 bps • Transmission format: Multi-drop link   • Wiring length: 500 m | |
| | RS-485 terminals | TXD+, TXD- | Inverter transmission terminal | With the RS-485 terminals, communication can be made through RS-485. | |
| | | RXD+, RXD- | Inverter reception terminal | • Conforming standard: EIA-485(RS-485)   • Communication speed: 300 to 115200 bps • Transmission format: Multi-drop link   • Overall extension: 500 m | |
| | | SG | Earth (Ground) | | |
| | | — | USB A connector | A connector (receptacle). A USB memory device enables parameter copies and the trace function. | Interface: Conforms to USB1.1 (USB2.0 full-speed compatible). Transmission speed: 12 Mbps |
| | | | USB B connector | Mini B connector (receptacle). Connected to a personal computer via USB to enable setting, monitoring, test operations of the inverter by FR Configurator2. | |
| Safety stop signal | | S1 | Safety stop input (Channel 1) | The terminals S1 and S2 are used for the safety stop input signal for the safety relay module. The terminals S1 and S2 are used at the same time (dual channel). Inverter output is shutoff by shortening/opening between terminals S1 and SIC, or between S2 and SIC. In the initial status, terminals S1 and S2 are shorted with the terminal PC by shorting wires. The terminal SIC is shorted with the terminal SD. Remove the shorting wires and connect the safety relay module when using the safety stop function. | Input resistance 4.7 kΩ Input current 4 to 6 mADC (with 24 VDC input) |
| | | S2 | Safety stop input (Channel 2) | | |
| | | SIC | Safety stop input terminal common | Common terminal for terminals S1 and S2. | — |
| | | SO | Safety monitor output (open collector output) | Indicates the safety stop input signal status. Switched to LOW when the status is other than the internal safety circuit failure. Switched to HIGH during the internal safety circuit failure status. (LOW is when the open collector output transistor is ON (conducted). HIGH is when the transistor is OFF (not conducted).) Refer to the Safety stop function instruction manual (BCN-A23228-001) when the signal is switched to HIGH while both terminals S1 and S2 are open. | Permissible load 24 VDC (27 VDC at maximum), 0.1 A (A voltage drop is 3.4 V at maximum while the signal is ON.) (A voltage drop is 3.4 V at maximum while the signal is ON.) |
| | | SOC | Safety stop input terminal common | Common terminal for terminal SO. | — |

*1 Terminals R/L1, S/L2, T/L3, PR, P3, P1, and PX are not provided in the separated converter type.
*2 The terminal P3 is equipped in the FR-F820-00770(18.5K) to 01250(30K) and the FR-F840-00470(22K) to 01800(75K).
*3 The sink logic is initially set for the FM-type inverter.
*4 The source logic is initially set for the CA-type inverter.
*5 Terminal FM is provided in the FM-type inverter.
*6 Terminal CA is provided in the CA-type inverter.
*7 Function and name of the separated converter type.

## ● Converter unit (FR-CC2)

indicates that terminal functions can be selected from **Pr.178, Pr.187, Pr.189 to Pr.195 (I/O terminal function selection)**.
Terminal names and terminal functions are those of the factory set.

| Type | Terminal Symbol | Terminal Name | Description | |
|---|---|---|---|---|
| **Main circuit** | R/L1, S/L2, T/L3 | AC power input | Connect these terminals to the commercial power supply. | |
| | R1/L11,S1/L21 | Power supply for the control circuit | Connected to the AC power supply terminals R/L1 and S/L2. To retain the fault display and fault output, remove the jumpers across terminals R/L1 and R1/L11 and across S/L2 and S1/L21 and supply external power to these terminals. | |
| | P/+, N/- | Inverter connection | Connect to terminals P/+ and N/- of the inverter. | |
| | ⏚ | Earth (ground) | For earthing (grounding) the converter unit chassis. This must be earthed (grounded). | |
| **Control circuit/input signal** — **Contact input** | RES | Reset | Use this signal to reset a fault output provided when a protective function is activated. Turn ON the RES signal for 0.1 s or longer, then turn it OFF.\nIn the initial setting, reset is always enabled. By setting **Pr.75**, reset can be set enabled only at fault occurrence of the converter unit. The inverter recovers about 1 s after the reset is released. | |
| | OH | External thermal relay input | The external thermal relay input (OH) signal is used when using an external thermal relay or a thermal protector built into the motor to protect the motor from overheating.\nWhen the thermal relay is activated, the inverter trips by the external thermal relay operation (E.OHT). | |
| | RDI | Contact input | The function can be assigned by setting **Pr.178**. | |
| | SD | Contact input common (sink) (Initial setting) | Common terminal for contact input terminal (sink logic). | |
| | | External transistor common (source) | Connect this terminal to the power supply common terminal of a transistor output (open collector output) device, such as a programmable controller, in the source logic to avoid malfunction by undesirable current. | |
| | | 24 VDC power supply common | Common terminal for the 24 VDC power supply (terminal PC, terminal +24)\nIsolated from terminal SE. | |
| | PC | External transistor common (sink) (Initial setting) | Connect this terminal to the power supply common terminal of a transistor output (open collector output) device, such as a programmable controller, in the source logic to avoid malfunction by undesirable current. | |
| | | Contact input common (source) | Common terminal for contact input terminal (source logic). | |
| | | 24 VDC power supply common | Can be used as a 24 VDC 0.1 A power supply. | |
| **Power supply input** | +24 | 24 V external power supply input | For connecting a 24 V external power supply.\nIf a 24 V external power supply is connected, power is supplied to the control circuit while the main power circuit is OFF. | Input voltage 23 to 25.5 VDC\nInput current 1.4 A or less |
| **Control circuit/output signal** — **Relay** | A1, B1, C1 | Relay output 1 (fault output) | 1 changeover contact output that indicates that the protective function of the converter unit has been activated and the outputs are stopped.\nFault: discontinuity across B and C (continuity across A and C), Normal: continuity across Band C (discontinuity across A and C) | Contact capacity 230 VAC 0.3 A (power factor = 0.4)\n30 VDC 0.3 A |
| | 88R, 88S | | For manufacturer setting. Do not use. | |
| **Open collector** | RDA | Inverter operation enable (NO contact) | Switched to LOW when the converter unit operation is ready.\nAssign the signal to the terminal MRS (X10) of the inverter.\nThe inverter can be started when the RDA status is LOW. | Permissible load 24 VDC (maximum 27 VDC) 0.1 A\n(The voltage drop is 2.8 V at maximum while the signal is ON.)\nLOW is when the open collector output transistor is ON (conducted).\nHIGH is when the transistor is OFF (not conducted). |
| | RDB | Inverter operation enable (NC contact) | Switched to LOW when a converter unit fault occurs or the converter is reset.\nThe inverter can be started when the RDB status is HIGH. | |
| | RSO | Inverter reset | Switched to LOW when the converter is reset (RES-ON).\nAssign the signal to the terminal RES of the inverter.\nThe inverter is reset when it is connected with the RSO status LOW. | |
| | IPF | Instantaneous power failure | Switched to LOW when an instantaneous power failure is detected. | |
| | FAN | Cooling fan fault | Switched to LOW when a cooling fan fault occurs. | |
| | SE | Open collector output common | Common terminal for terminals RDA, RDB, RSO, IPF, FAN | |
| **Communication** | — | PU connector | With the PU connector, communication can be made through RS-485. (For connection on a 1:1 basis only)\n• Conforming standard: EIA-485 (RS-485)\n• Transmission format: Multidrop link\n• Communication speed: 4800 to 115200 bps\n• Wiring length: 500 m | |
| | RS-485 terminals — TXD+ | Converter unit transmission terminal | The RS-485 terminals enable the communication by RS-485.\n• Conforming standard: EIA-485 (RS-485)\n• Transmission format: Multidrop link\n• Communication speed: 300 to 115200 bps\n• Overall length: 500 m | |
| | TXD- | | | |
| | RXD+ | Converter unit reception terminal | | |
| | RXD- | | | |
| | SG | Earthing (grounding) | | |

# ❖ Operation Panel (FR-DU08)

## ● Components of the operation panel



| No. | Component | Name | Description |
|---|---|---|---|
| (a) | PU / EXT / NET | Operation mode indicator *1 | PU: ON to indicate the PU operation mode.<br>EXT: ON to indicate the External operation mode. (ON at power-ON in the initial setting.)<br>NET: ON to indicate the Network operation mode.<br>PU and EXT: ON to indicate the External/PU combined operation mode 1 or 2. |
| (b) | MON / PRM | Operation panel status indicator | MON: ON to indicate the monitoring mode. Quickly flickers twice intermittently while the protective function is activated.<br>PRM: ON to indicate the parameter setting mode. |
| (c) | IM / PM | Control motor indicator *1 | IM: ON to indicate the induction motor control.<br>PM: ON to indicate the PM motor control.<br>The indicator flickers when test operation is selected. |
| (d) | Hz | Frequency unit indicator *1 | ON to indicate frequency. (Flickers when the set frequency is displayed in the monitor.) |
| (e) | (monitor display) | Monitor (5-digit LED) | Shows the frequency, parameter number, etc.<br>(Using **Pr.52, Pr.774 to Pr.776**, the monitored item can be changed.) |
| (f) | P.RUN | PLC function indicator *1 | ON to indicate that the PLC function is operating. |
| (g) | FWD / REV | FWD key, REV key *1 | FWD key: Starts forward rotation. The LED is lit during forward operation.<br>REV key: Starts reverse rotation. The LED is lit during reverse operation.<br>The LED flickers under the following conditions.<br>• When the frequency command is not given even if the forward/reverse command is given.<br>• When the frequency command is the starting frequency or lower.<br>• When the MRS signal is being input. |
| (h) | STOP/RESET | STOP/RESET key | Stops the operation commands.<br>Resets the inverter when the protection function is activated. |
| (i) | (setting dial) | Setting dial | The setting dial of the Mitsubishi inverters. The setting dial is used to change the frequency and parameter settings.<br>Press the setting dial to perform the following operations:<br>• To display a set frequency in the monitoring mode (the setting can be changed using **Pr.992**.)<br>• To display the present setting during calibration<br>• To display a fault history number in the faults history mode |
| (j) | MODE | MODE key | Switches to different modes.<br>Switches to the easy setting mode by pressing simultaneously with [PU/EXT].<br>Holding this key for 2 seconds locks the operation. The key lock is invalid when **Pr.161**="0 (initial setting)". |
| (k) | SET | SET key | Enters each setting.<br>If pressed during operation, the monitored item changes.<br>(Using **Pr.52, Pr.774 to Pr.776**, the monitored item can be changed.)<br>When the initial setting is set: Output frequency → Output current → Output voltage |
| (l) | ESC | ESC key | Goes back to the previous display.<br>Holding this key for a longer time changes the mode back to the monitor mode. |
| (m) | PU/EXT | PU/EXT key *1 | Switches between the PU mode and the External operation mode.<br>Switches to the easy setting mode by pressing simultaneously with [MODE].<br>Cancels the PU stop also. |

*1    Not available for the converter unit. (The operation panel of the inverter can be used.)

## ● Basic operation(FR-DU08)

**Operation mode switchover/Frequency setting**

**External operation mode**∗1(At power-ON)　　**PU operation mode**∗1　　**PU Jog operation mode**∗1

PU/EXT

PU　MON　IM
EXT　PRM　PM
NET　P.RUN

0.00 Hz

PU/EXT

0.00 Hz

PU/EXT

JOG Hz

(Example)　Flicker

60.00　　SET　　F　　　60.00

**Value change**　　Frequency setting has been
written and completed!!

---

**Monitor**

0.00 Hz

PU　MON　IM
EXT　PRM　PM
NET　P.RUN

Parameter setting mode (At power-ON)∗2

SET　　0.00A Hz　　SET　　0.0V Hz

Output current monitor∗2　　Output voltage monitor∗2

SET

MODE

---

**Parameter setting**

P.　　0 Hz

PU　MON　IM
EXT　PRM　PM
NET　P.RUN

Parameter setting mode

MODE

P.　79　　SET　　0

Display the present
setting

(Example)　Flicker

2　　SET　　2　P.　79

**Value change**　　Parameter write is completed!!

∗5

MODE

Pr.CLR　→　ALLCL　→　ErrCL　→　Pr.CPY
Parameter clear　　All parameter clear　　Faults history clear　　Parameter copy

Pr.Md　←　AUTO　←　IPM　←　Pr.CHG
Group parameter setting　Automatic parameter setting　IPM parameter initialization　Initial value change list

---

**Function**

FUNC. Hz

PU　MON　IM
EXT　PRM　PM
NET　P.RUN

Function mode

SET　　rRC--　　PGr--
Trace function ∗3　　PID gain tuning ∗3

MODE

---

**Faults history**

E-----

(Example)　Flickering
E.rHM
Faults history 1 ∗4

(Example)　Flickering
E　PUE
Faults history 2 ∗4

(Example)　Flickering
E　　0
Faults history 8 ∗4

[Operation for displaying faults history]
Past eight faults can be displayed.
(The latest fault is ended by ".".)
When no fault history exists, E　　0 is displayed.

ESC
Long press

---

∗1　For the details of operation modes, refer to **page 45**.
∗2　Monitored items can be changed.
∗3　For the details, refer to the Instruction Manual (Detailed).
∗4　While a fault is displayed, the display shifts as follows by pressing SET : Output frequency at the fault → Output current → Output voltage → Energization
　　time → Year → Month → Date → Time. (After Time, it goes back to a fault display.) Pressing the setting dial shows the fault history number.
∗5　The USB memory mode will appear if a USB memory device is connected. (Refer to **page 42**.)
∗6　Not available for the FR-CC2.

## ● Parameter copy to the USB memory device

Insert the USB memory in the inverter. The USB memory mode is displayed and USB memory operations are possible.

Monitor mode        Parameter setting mode        Function mode        Faults history mode

[MODE] [MODE] [MODE]

[MODE] [MODE]

**USB memory mode**

USb-A [SET] [ESC] -MEM [SET] [ESC] MCPY

[SET]

[ESC]

CP---- [SET] [ESC] 0.----

CP001 [SET] [ESC] 0.----

IRd — Copy the parameter setting from the inverter to the USB memory device.

CP002

IRd [SET] — Overwrite the inverter parameter setting onto the designated file in the USB memory device.

CP099

2.WR [SET] 2. ALL [SET] — Write the designated parameter setting file of the USB memory device to a parameter file of the inverter.

Parameter setting file number saved in the USB memory device (up to 99)

3.VFY [SET] 3. ALL [SET] — Verify the designated parameter setting file of the USB memory device against the parameter file of the inverter.

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## ● Group parameter display

Parameter numbers can be changed to grouped parameter numbers.
Parameters are grouped by their functions. The related parameters can be set easily.

### (1)   Changing to the grouped parameter numbers

| Pr.MD setting value | Description |
|---|---|
| 0 | No change |
| 1 | Parameter display by number |
| 2 | Parameter display by function |

## Operation

| | |
|---|---|
| 1. | **Screen at power-ON**<br>The monitor display appears. |
| 2. | **Parameter setting mode**<br>Press ⟨MODE⟩ to choose the parameter setting mode. (The parameter number read previously appears.) |
| 3. | **Selecting the parameter number**<br>Turn ⊚ until $Pr$-$Md$ (parameter display method) appears.<br>Press ⟨SET⟩. "$0$" (initial value) will appear. |
| 4. | **Changing to the group parameter display**<br>Turn ⊚ to change the set value to "$2$" (group parameter display). Press ⟨SET⟩ to select the group parameter setting. "$2$" and "$Pr$-$Md$" flicker alternately after the setting is completed. |

### (2)   Changing parameter setting in the group parameter display

| Changing example | Change the **P.H400(Pr.1) Maximum frequency**. |
|---|---|

## Operation

| | |
|---|---|
| 1. | **Screen at power-ON**<br>The monitor display appears. |
| 2. | **Changing the operation mode**<br>Press ⟨PU/EXT⟩ to choose the PU operation mode. [PU] indicator is lit. |
| 3. | **Parameter setting mode**<br>Press ⟨MODE⟩ to choose the parameter setting mode. (The parameter number read previously appears.) |
| 4. | **Parameter group selection**<br>Press ⟨ESC⟩ several times until $PA0$ . .appears.<br>(No need to press ⟨ESC⟩ if the previously read parameter is one of $Pr$.$CLR$ to $Pr$-$Md$.) Skip this operation and proceed to step 5..) |
| 5. | **Parameter group selection**<br>Turn ⊚ until $PH4$ . . (protective function parameter 4) appears. Press ⟨SET⟩ to display $PH4$-- -- and make the group parameters of the protective function parameter 4 selectable. |
| 6. | **Parameter selection**<br>Turn ⊚ until $PH400$ (P.H400 Maximum frequency) appears. Press ⟨SET⟩ to read the present set value.<br>"$120.00$" (initial value) appears. |
| 7. | **Changing the setting value**<br>Turn ⊚ to change the set value to "$60.00$". Press ⟨SET⟩ to enter the setting. "$60.00$" and "$PH400$" flicker alternately after the setting is completed. |

# Details on the LCD operation panel (FR-LU08)

- The FR-LU08 is an optional operation panel adopting an LCD panel capable of displaying text and menus.
- Replacement with the operation panel (FR-DU08) and installation on the enclosure surface using a connection cable (FR-CB2) are possible. (To connect the FR-LU08, an optional operation panel connection connector (FR-ADP) is required.)
- Parameter settings for up to three inverters can be saved.
- When the FR-LU08 is connected to the inverter, the internal clock of the inverter can be synchronized with the clock of FRLU08. (Real time clock function)
  With a battery (CR1216), the FR-LU08 time count continues even if the main power of the inverter is turned OFF. (The time count of the inverter internal clock does not continue when the inverter power is turned OFF.)
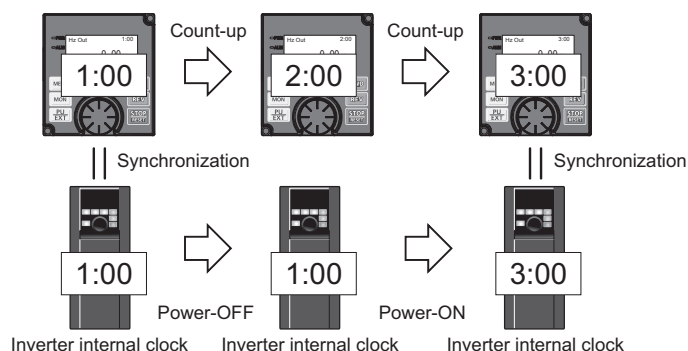


## ● Appearance and parts name
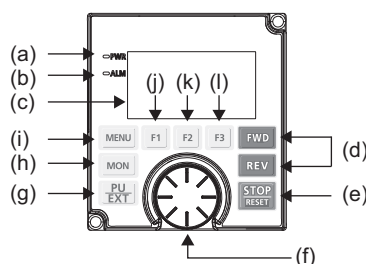


| Symbol | Name | Description |
|---|---|---|
| a | Power lamp | ON when the power is turned ON. |
| b | Alarm lamp | ON when an inverter alarm occurs. |
| c | Monitor | Shows the frequency, parameter number, etc. (Using **Pr.52, Pr.774 to Pr.776**, the monitored item can be changed.) |
| d | FWD key, REV key | FWD key: Starts the forward operation. REV key: Starts the reverse operation. |
| e | STOP/RESET key | Used to stop operation commands. Used to reset the inverter when the protective function is activated. |
| f | Setting dial | The setting dial is used to change the frequency and parameter settings. Pressing the dial shows details of the faults history mode. |
| g | PU/EXT key | Switches between the PU mode, the PUJOG mode, and the External operation mode. |
| h | MON key | Shows the first monitored item. |
| i | MENU key | Displays the quick menu. Pressing the key while the quick menu is displayed displays the function menu. |
| j | Software key (F1) | |
| k | Software key (F2) | Select a guidance displayed on the monitor. |
| l | Software key (F3) | |

## ● Switching the main monitor data

When **Pr.52 Operation panel main monitor selection** is set to "0", by pressing [F1] (PREV) or [F3] (NEXT) 6 types of monitor data are displayed in order.

# ❖ Operation steps

━━ : Initial setting

Frequency command

Frequency (Hz) — Inverter output frequency

Time (S)

Start command — ON

---

Step of operation

↓

Installation/mounting

↓

Wiring of the power supply and motor

↓

Control mode selection

↓

**How to give a start command?**

→ Start command using the PU connector and RS-485 terminal of the inverter and plug-in option (Communication)

Start command with FWD / REV on the operation panel (PU)

Connect a switch, relay, etc. to the control circuit terminal block of the inverter to give a start command. (External)

**How to give a frequency command?**

| Set from the PU (FR-DU08/FR-LU08/FR-PU07). (PU) | Change frequency with ON/OFF switches connected to terminals (multi-speed setting) (External) | Perform frequency setting by a voltage output device (Connection across terminals 2 and 5) (External) | Perform frequency setting by a current output device (Connection across terminals 4 and 5) (External) |
|---|---|---|---|
| (Refer to **page 46**) | (Refer to **page 47**) | (Refer to **page 48**) | (Refer to **page 49**) |

**How to give a frequency command?**

| Set from the PU (FR-DU08/FR-LU08/FR-PU07). (PU) | Change of frequency with ON/OFF switches connected to terminals (multi-speed setting) (External) | Perform frequency setting by a voltage output device (Connection across terminals 2 and 5) (External) | Perform frequency setting by a current output device (Connection across terminals 4 and 5) (External) |
|---|---|---|---|
| (Refer to **page 50**) | (Refer to **page 51**) | (Refer to **page 52**) | (Refer to **page 54**) |

## ● Basic operation procedure (PU operation)

## ◆ Operating at a set frequency (example: operating at 30 Hz)

**POINT**

- Use the operation panel (FR-DU08) to give a start command and a frequency command. (PU operation)

Operation panel
(FR-DU08)
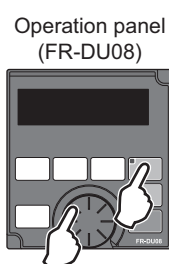
| Operation example | Operate at 30 Hz. |

## Operation

| 1. | Screen at power-ON<br>The monitor display appears. |
|----|---|
| 2. | Changing the operation mode<br><br>Press $\boxed{\frac{PU}{EXT}}$ to choose the PU operation mode. [PU] indicator is on. |
| 3. | Setting the frequency<br><br>Turn 🔘 until the target frequency, " **30.00** " (30.00 Hz), appears. The frequency flickers for about 5 s.<br><br>While the value is flickering, press $\boxed{SET}$ to enter the frequency. "**F**" and "**30.00**" flicker alternately. After about 3 s of flickering, the indication goes back to "**0.00**" (monitor display).<br><br>(If $\boxed{SET}$ is not pressed, the indication of the value goes back to "**0.00**" (0.00 Hz) after about 5 s of flickering.In that case, turn 🔘 again and set the frequency.) |
| 4. | Start → acceleration → constant speed<br><br>Press $\boxed{FWD}$ or $\boxed{REV}$ to start running. The frequency value on the indication increases in **Pr.7 Acceleration time**, and "**30.00**" (30.00 Hz) appears.<br>(To change the set frequency, perform the operation in above step 3. The previously set frequency appears.) |
| 5. | Deceleration → stop<br><br>Press $\boxed{\frac{STOP}{RESET}}$ to stop. The frequency value on the indication decreases in **Pr.8 Deceleration time**, and the motor stops rotating with "**0.00**" (0.00 Hz) displayed. |

**NOTE**

- To display the set frequency under PU operation mode or External/PU combined operation mode 1 (**Pr.79** = "3"), press 🔘.
  (Refer to **the Instruction Manual (Detailed)**.)
- 🔘 can also be used like a potentiometer to perform operation. (Refer to **the Instruction Manual (Detailed)**.)

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◆ **Setting the frequency by switches (multi-speed setting)**

**POINT**

- Use the operation panel (FR-DU08) ( FWD or REV ) to give a start command.
- Turn ON the RH, RM, or RL signal to give a frequency command. (multi-speed setting)
- Set **Pr.79 Operation mode selection** = "4" (External/PU combination operation mode 2).

[Connection diagram]
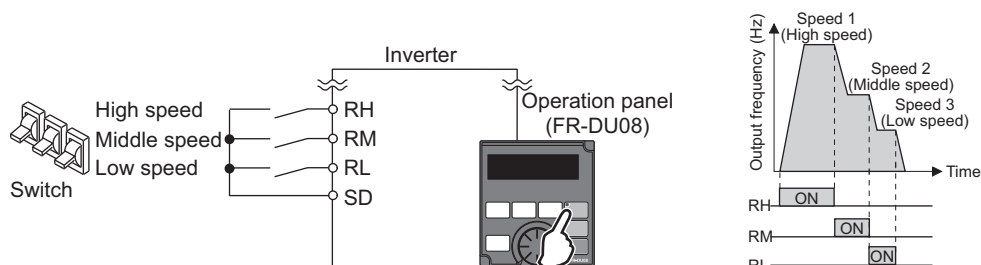


| Operation example | Operate at a low-speed (10 Hz). |

## Operation

| 1. | **Screen at power-ON**<br>The monitor display appears. |
|---|---|
| 2. | **Changing the operation mode**<br>Set "4" in **Pr.79**. [PU] and [EXT] indicators are on. (For setting value change, refer to **page 41**.) |
| 3. | **Setting the frequency**<br>Turn ON the low-speed switch (RL). |
| 4. | **Start → acceleration → constant speed**<br>Press FWD or REV to start running. The frequency value on the indication increases in **Pr.7 Acceleration time**, and " *1000* " (10.00 Hz) appears. |
| 5. | **Deceleration → stop**<br>Press STOP/RESET to stop. The frequency value on the indication decreases in **Pr.8 Deceleration time**, and the motor stops rotating with " *000* " (0.00 Hz) displayed. Turn OFF the low-speed switch (RL). |

**NOTE**

- The terminal RH is initially set to 60 Hz for the FM type inverter, and to 50 Hz for the CA type inverter. The terminal RM is set to 30 Hz, and the RL is set to 10 Hz. (To change, set **Pr.4, Pr.5, and Pr.6**.)
- In the initial setting, when two or more of multi-speed settings are simultaneously selected, priority is given to the set frequency of the lower signal.
  For example, when RH and RM signals turn ON, RM signal (**Pr.5**) has a higher priority.
- Maximum of 15-speed operation can be performed.

## ◆ Setting the frequency with analog signals (voltage input)

### POINT

- Use the operation panel (FR-DU08) ( FWD or REV ) to give a start command.
- Use the potentiometer (frequency setting potentiometer) to give a frequency command (by connecting it across terminals 2 and 5 (voltage input)).
- Set **Pr.79 Operation mode selection** = "4" (External/PU combination operation mode 2).

[Connection diagram] (The inverter supplies 5 V power to the frequency setting potentiometer (terminal 10).)

Inverter

Operation panel (FR-DU08)

10
2
5

Frequency setting potentiometer

Potentiometer
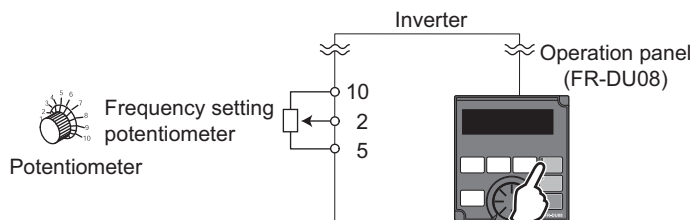
| Operation example | Operate at 60 Hz. |

## Operation

| 1. | **Screen at power-ON**<br>The monitor display appears. |
|---|---|
| 2. | **Changing the operation mode**<br>Set "4" in **Pr.79**. [PU] and [EXT] indicators are on. (For setting value change, refer to **page 41**.) |
| 3. | **Start**<br>Press FWD or REV . [FWD] or [REV] flickers as no frequency command is given. |
| 4. | **Acceleration → constant speed**<br>Turn the potentiometer (frequency setting potentiometer) clockwise slowly to full. The frequency value on the indication increases in **Pr.7 Acceleration time**, and " 60.00 " (60.00 Hz) appears. |
| 5. | **Deceleration**<br>Turn the potentiometer (frequency setting potentiometer) counterclockwise slowly to full. The frequency value on the indication decreases in **Pr.8 Deceleration time**, and the motor stops rotating with " 0.00 " (0.00 Hz) displayed. [FWD] or [REV] indicator flickers. |
| 6. | **Stop**<br>Press STOP/RESET . [FWD] or [REV] indicator turns OFF. |

### NOTE

- To change the frequency (60 Hz) at the maximum voltage input (initial value 5 V), adjust **Pr.125 Terminal 2 frequency setting gain frequency**.
- To change the frequency (0 Hz) at the minimum voltage input (initial value 0 V), adjust the **calibration parameter C2 Terminal 2 frequency setting bias frequency**.

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## ◆ Using an analog signal (current input) to give a frequency command

### POINT

- Use the operation panel (FR-DU08) ( FWD or REV ) to give a start command.
- Use the outputs from the current signal source (4 to 20 mA) to give a frequency command (by connecting it across terminals 4 and 5 (current input)).
- Turn ON the AU signal.
- Set **Pr.79 Operation mode selection** = "4" (External/PU combination operation mode 2).

[Connection diagram]



| Operation example | Operate at 60 Hz. |

## Operation

| 1. | **Screen at power-ON** |
| | The monitor display appears. |
| 2. | **Changing the operation mode** |
| | Set "4" in **Pr.79**. [PU] and [EXT] indicators are on. (For setting value change, refer to **page 41**.) |
| 3. | **Terminal 4 input selection** |
| | Turn ON the terminal 4 input selection signal (AU). Input to the terminal 4 is enabled. |
| 4. | **Start** |
| | Press FWD or REV . [FWD] or [REV] flickers as no frequency command is given. |
| 5. | **Acceleration → constant speed** |
| | Input 20 mA. The frequency value on the indication increases in **Pr.7 Acceleration time**, and " 60.00 " (60.00 Hz) appears. |
| 6. | **Deceleration** |
| | Input 4 mA or less. The frequency value on the indication decreases in **Pr.8 Deceleration time**, and the motor stops rotating with " 0.00 " (0.00 Hz) displayed. [FWD] or [REV] indicator flickers. |
| 7. | **Stop** |
| | Press STOP RESET . [FWD] or [REV] indicator turns OFF. |

### NOTE

- **Pr.184 AU terminal function selection** must be set to "4" (AU signal) (initial value).
- To change the frequency (60 Hz) at the maximum current input (initial value 20 mA), adjust **Pr.126 Terminal 4 frequency setting gain frequency**.
- To change the frequency (0 Hz) at the minimum current input (initial value 4 mA), adjust the **calibration parameter C5 Terminal 4 frequency setting bias frequency**.

## ● Basic operation procedure (External operation)

### ◆ Using the frequency set by the operation panel

**POINT**

- Switch ON the STF (STR) signal to give a start command.
- Use the operation panel (FR-DU08) (  ) to give a start command.
- Set **Pr.79** = "3" (External/PU combined operation mode 1).

[Connection diagram]

Inverter

Forward rotation start
Reverse rotation start

Switch

STF
STR
SD

Operation panel (FR-DU08)
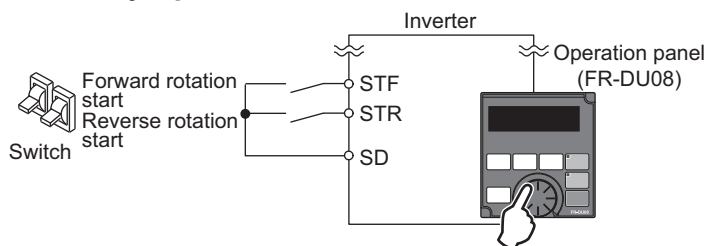
| **Operation example** | Operate at 30 Hz. |

## Operation

| 1. | **Changing the operation mode** |
|----|----|
|    | Set "3" in **Pr.79**. [PU] and [EXT] indicators are on. (For setting value change, refer to **page 41**.) |

| 2. | **Setting the frequency** |
|----|----|
|    | Turn  to until the target frequency, " ⨳⨳⨳⨳ " (30.00 Hz), appears. The frequency flickers for about 5 s. |
|    | While the value is flickering, press  SET  to enter the frequency. "F " and " ⨳⨳⨳⨳ " flicker alternately. After about 3 s of flickering, the indication goes back to " ⨳⨳⨳ " (monitor display). |
|    | (If  SET  is not pressed, the indication of the value goes back to " ⨳⨳⨳ " (0.00 Hz) after about 5 s of flickering. In that case, turn  again and set the frequency.) |

| 3. | **Start → acceleration → constant speed** |
|----|----|
|    | Turn ON the start switch (STF or STR). The frequency value on the indication increases in **Pr.7 Acceleration time**, and " ⨳⨳⨳⨳ " (30.00 Hz) appears. [FWD] indicator is on during the forward rotation, and [REV] indicator is on during the reverse rotation.<br>(To change the set frequency, perform the operation in above step 2. The previously set frequency appears.) |

| 4. | **Deceleration → stop** |
|----|----|
|    | Turn OFF the start switch (STF or STR). The frequency value on the indication decreases in **Pr.8 Deceleration time**, and the motor stops rotating with " ⨳⨳⨳ " (0.00 Hz) displayed. |

**NOTE**

- When both the forward rotation switch (STF) and the reverse rotation switch (STR) are ON, the motor cannot be started. If both are turned ON while the inverter is running, the inverter decelerates to a stop.
- **Pr.178 STF terminal function selection** must be set to "60" (or **Pr.179 STR terminal function selection** must be set to "61"). (All are initial values.)
- Setting **Pr.79 Operation mode selection**="3" also enables multi-speed operation.
- If stopped using  STOP RESET  on the operation panel (FR-DU08) during the External operation, the inverter enters the PU stop status. ( PS appears on the operation panel.)
- To reset the PU stop status, turn OFF the start switch (STF or STR), and then press  PU EXT .

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◆ **Setting the frequency by switches (multi-speed setting) (Pr.4 to Pr.6)**

- Switch ON the STF (STR) signal to give a start command.
- Turn ON the RH, RM, or RL signal to give a frequency command. (Multi-speed setting)

[Connection diagram]

Inverter

Forward rotation start — STF
Reverse rotation start — STR
High speed — RH
Middle speed — RM
Low speed — RL
— SD

Switch

Output frequency (Hz)

Speed 1 (High speed)
Speed 2 (Middle speed)
Speed 3 (Low speed)

Time

RH ON
RM ON
RL ON
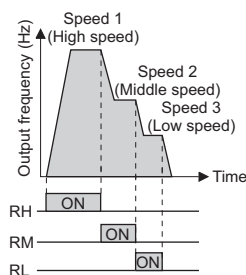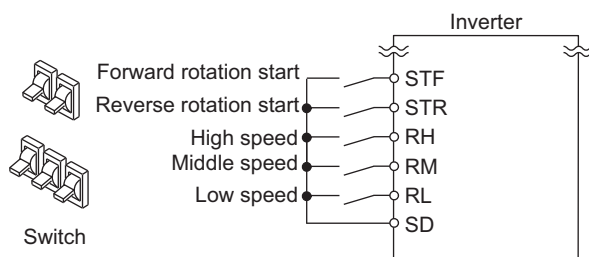
| **Changing example** | Operate at a high-speed (60 Hz). |

## Operation

**1.** **Screen at power-ON**
The monitor display appears.

**2.** **Setting the frequency**
Turn ON the high-speed switch (RH).

**3.** **Start → acceleration → constant speed**
Turn ON the start switch (STF or STR). The frequency value on the indication increases in **Pr.7 Acceleration time**, and "*60.00*" (60.00 Hz) appears. [FWD] indicator is on during the forward rotation, and [REV] indicator is on during the reverse rotation.
● When RM is turned ON, 30 Hz is displayed. When RL is turned ON, 10 Hz is displayed.

**4.** **Deceleration → stop**
Turn OFF the start switch (STF or STR).The frequency value on the indication decreases in **Pr.8 Deceleration time**, and the motor stops rotating with "*0.00*" (0.00 Hz) displayed. [FWD] or [REV] indicator turns OFF. Turn OFF the high-speed switch (RH).

**NOTE**
- When both the forward rotation switch (STF) and the reverse rotation switch (STR) are ON, the motor cannot be started. If both are turned ON while the inverter is running, the inverter decelerates to a stop.
- The terminal RH is initially set to 60 Hz for the FM type inverter, and to 50 Hz for the CA type inverter. The terminal RM is set to 30 Hz, and the RL is set to 10 Hz. (To change, set **Pr.4, Pr.5, and Pr.6**.)
- In the initial setting, when two or more of multi-speed settings are simultaneously selected, priority is given to the set frequency of the lower signal.
  For example, when RH and RM signals turn ON, RM signal (**Pr.5**) has a higher priority.
- Maximum of 15-speed operation can be performed.

◆ **Setting the frequency with analog signals (voltage input)**

• Switch ON the STF (STR) signal to give a start command.
• Use the potentiometer (frequency setting potentiometer) to give a frequency command. (by connecting it across terminals 2 and 5 (voltage input)).

[Connection diagram]
(The inverter supplies 5 V power to the frequency setting potentiometer (terminal 10).)

Inverter

Forward rotation start — STF
Reverse rotation start — STR
— SD

Switch

Frequency setting potentiometer — 10
2
5

Potentiometer

| Operation example | Operate at 60 Hz. |
|---|---|

## Operation

| 1. | Screen at power-ON |
|---|---|
| | The monitor display appears. |
| 2. | Start |
| | Turn ON the start switch (STF or STR). [FWD] or [REV] flickers as no frequency command is given. |
| 3. | Acceleration → constant speed |
| | Turn the potentiometer (frequency setting potentiometer) clockwise slowly to full. The frequency value on the indication increases in **Pr.7 Acceleration time**, and " 60.00 " (60.00 Hz) appears. [FWD] indicator is on during the forward rotation, and [REV] indicator is on during the reverse rotation. |
| 4. | Deceleration |
| | Turn the potentiometer (frequency setting potentiometer) counterclockwise slowly to full. The frequency value on the indication decreases in **Pr.8 Deceleration time**, and the motor stops rotating with " 0.00 " (0.00 Hz) displayed. |
| 5. | Stop |
| | Turn OFF the start switch (STF or STR). [FWD] or [REV] indicator turns OFF. |

**NOTE**
• When both the forward rotation switch (STF) and the reverse rotation switch (STR) are ON, the motor cannot be started. If both are turned ON while the inverter is running, the inverter decelerates to a stop.
• **Pr.178 STF terminal function selection** must be set to "60" (or **Pr.179 STR terminal function selection** must be set to "61"). (All are initial values.)

## ◆ Changing the frequency (60 Hz, initial value) at the maximum voltage input (5 V, initial value)

Change the maximum frequency.

| Changing example | With a 0 to 5 VDC input frequency setting potentiometer, change the frequency at 5 V from 60 Hz (initial value) to 50 Hz.<br>Adjust the setting so that the inverter outputs 50 Hz when 5 V is input.<br>Set "50 Hz" in **Pr.125**. |

## Operation

**1. Parameter selection**

Turn ⊛ until ⨀ ┌25 **(Pr.125)** appears.

Press [SET] to show the present set value. (60.00 Hz)

**2. Changing the maximum frequency**

Turn ⊛ to change the set value to "5000". (50.00 Hz)

Press [SET] to enter the setting. "5000" and "P. 125" flicker alternately.

**3. Checking the mode/monitor**

Press [MODE] three times to change to the monitor / frequency monitor.

**4. Start**

Turn ON the start switch (STF or STR), then turn the potentiometer (frequency setting potentiometer) clockwise slowly to full. (Refer to steps 2 and 3 in **page 52**.)
Operate at 50 Hz.

### NOTE

• To set the frequency at 0 V, use the **calibration parameter C2**.
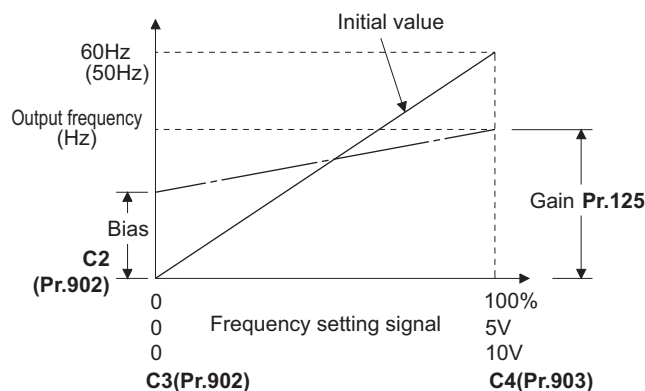
• Other adjustment methods for the frequency setting voltage gain are the following: adjustment by applying a voltage directly across terminals 2 and 5, and adjustment using a specified point without applying a voltage across terminals 2 and 5.

◆ **Using an analog signal (current input) to give a frequency command**

**POINT**

• Switch ON the STF (STR) signal to give a start command.
• Turn ON the AU signal.

[Connection diagram]



| Operation example | Operate at 60 Hz. |

---

## Operation

| | |
|---|---|
| **1.** | **Screen at power-ON** <br> The monitor display appears. |
| **2.** | **Terminal 4 input selection** <br> Turn ON the terminal 4 input selection signal (AU). Input to the terminal 4 is enabled. |
| **3.** | **Start** <br> Turn ON the start switch (STF or STR). [FWD] or [REV] flickers as no frequency command is given. |
| **4.** | **Acceleration → constant speed** <br> Input 20 mA.The frequency value on the indication increases in **Pr.7 Acceleration time**, and " 60.00 " (60.00 Hz) appears. [FWD] indicator is on during the forward rotation, and [REV] indicator is on during the reverse rotation. |
| **5.** | **Deceleration** <br> Input 4 mA or less.The frequency value on the indication decreases in **Pr.8 Deceleration time**, and the motor stops rotating with " 0.00 " (0.00 Hz) displayed. [FWD] or [REV] indicator flickers. |
| **6.** | **Stop** <br> Turn OFF the start switch (STF or STR). [FWD] or [REV] indicator turns OFF. |

**NOTE**

• When both the forward rotation switch (STF) and the reverse rotation switch (STR) are ON, the motor cannot be started. If both are turned ON while the inverter is running, the inverter decelerates to a stop.
• **Pr.184 AU terminal function selection** must be set to "4" (AU signal) (initial value).

◆ **Changing the frequency (60 Hz, initial value) at the maximum current input (at 20 mA, initial value)**
Change the maximum frequency.

| Changing example | With a 4 to 20 mA input frequency setting potentiometer, change the frequency at 20 mA from 60 Hz (initial value) to 50 Hz. |
|---|---|

Adjust the setting so that the inverter outputs 50 Hz when 20 mA is input.
Set "50 Hz" in **Pr.126**.

## Operation

| 1. | **Parameter selection** |
|---|---|
| | Turn ⊛ until $P.\ 126$ **(Pr.126)** appears. |
| | Press SET to show the present set value. (60.00 Hz) |
| 2. | **Changing the maximum frequency** |
| | Turn ⊛ to change the set value to "$50.00$". (50.00 Hz) |
| | Press SET to enter the setting. "$50.00$" and "$P.\ 126$" flicker alternately. |
| 3. | **Checking the mode/monitor** |
| | Press MODE three times to change to the monitor / frequency monitor. |
| 4. | **Start** |
| | Turn ON the start switch (STF or STR), then turn the potentiometer (frequency setting potentiometer) clockwise slowly to full. (Refer to steps 3 and 4 in **page 54**.) |
| | Operate at 50 Hz. |

**NOTE**
• To set the frequency at 4 mA, use the **calibration parameter C5**.

| | | | | |
|---|---|---|---|---|
| | | 0 | 20 | 100% |
| | | 0 | 4 | 20mA |
| | | 0 | 1 | 5V |
| | | 0 | 2 | 10V |
| | | **C6(Pr.904)** | | **C7(Pr.905)** |

Initial value — Gain **Pr.126** — Bias **C5 (Pr.904)** — 60Hz (50Hz) — Output frequency (Hz) — Frequency setting signal
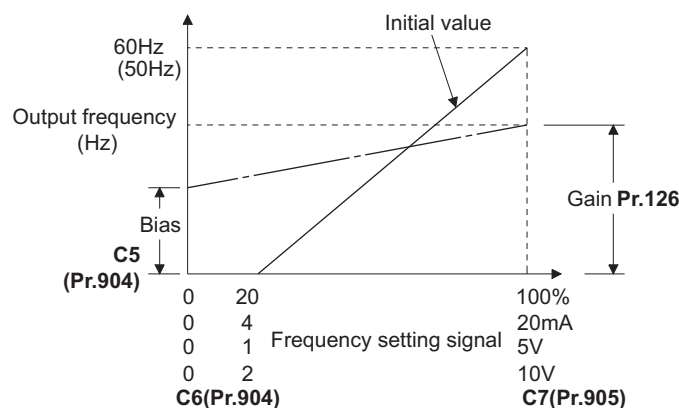
• Other adjustment methods for the frequency setting current gain are the following: adjustment by applying a current through terminals 4 and 5, and adjustment using a specified point without applying a current through terminals 4 and 5.

# Parameter List

## ● Inverter parameter list (by parameter number)

For simple variable-speed operation of the inverter, the initial value of the parameters may be used as they are. Set the necessary parameters to meet the load and operational specifications. Parameter setting, change and check can be made from the operation panel (FR-DU08).

**NOTE**

- *Simple* indicates simple mode parameters. Use **Pr.160 User group read selection** to indicate the simple mode parameters only.
- Parameter setting may be restricted in some operating statuses. Use **Pr.77 Parameter write selection** to change the setting.

| Function | Pr. | Pr. group | Name | Setting range | Minimum setting increments | Initial value FM | Initial value CA | Customer setting |
|---|---|---|---|---|---|---|---|---|
| Basic functions | 0 | G000 | Torque boost *Simple* | 0 to 30% | 0.1% | 6% *1 / 4% *1 / 3% *1 / 2% *1 / 1.5% *1 / 1% *1 | | |
| | 1 | H400 | Maximum frequency *Simple* | 0 to 120 Hz | 0.01 Hz | 120 Hz *2 / 60 Hz *3 | | |
| | 2 | H401 | Minimum frequency *Simple* | 0 to 120 Hz | 0.01 Hz | 0 Hz | | |
| | 3 | G001 | Base frequency *Simple* | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | |
| | 4 | D301 | Multi-speed setting (high speed) *Simple* | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | |
| | 5 | D302 | Multi-speed setting (middle speed) *Simple* | 0 to 590 Hz | 0.01 Hz | 30 Hz | | |
| | 6 | D303 | Multi-speed setting (low speed) *Simple* | 0 to 590 Hz | 0.01 Hz | 10 Hz | | |
| | 7 | F010 | Acceleration time *Simple* | 0 to 3600 s | 0.1 s | 5 s *4 / 15 s *5 | | |
| | 8 | F011 | Deceleration time *Simple* | 0 to 3600 s | 0.1 s | 10 s *4 / 30 s *5 | | |
| | 9 | H000 / C103 | Electronic thermal O/L relay *Simple* / Rated motor current *Simple* | 0 to 500 A / 0 to 3600 A | 0.01 A *2 / 0.1 A *3 | Rated inverter current | | |
| DC injection brake | 10 | G100 | DC injection brake operation frequency | 0 to 120 Hz, 9999 | 0.01 Hz | 3 Hz | | |
| | 11 | G101 | DC injection brake operation time | 0 to 10 s, 8888 | 0.1 s | 0.5 s | | |
| | 12 | G110 | DC injection brake operation voltage | 0 to 30% | 0.1% | 4% *6 / 2% *6 / 1% *6 | | |
| – | 13 | F102 | Starting frequency | 0 to 60 Hz | 0.01 Hz | 0.5 Hz | | |
| – | 14 | G003 | Load pattern selection | 0, 1 | 1 | 1 | | |
| Jog operation | 15 | D200 | Jog frequency | 0 to 590 Hz | 0.01 Hz | 5 Hz | | |
| | 16 | F002 | Jog acceleration/deceleration time | 0 to 3600 s | 0.1 s | 0.5 s | | |
| – | 17 | T720 | MRS input selection | 0, 2, 4 | 1 | 0 | | |
| – | 18 | H402 | High speed maximum frequency | 0 to 590 Hz | 0.01 Hz | 120 Hz *2 / 60 Hz *3 | | |
| – | 19 | G002 | Base frequency voltage | 0 to 1000 V, 8888, 9999 | 0.1 V | 9999 | 8888 | |
| Acceleration/ deceleration times | 20 | F000 | Acceleration/deceleration reference frequency | 1 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | |
| | 21 | F001 | Acceleration/deceleration time increments | 0, 1 | 1 | 0 | | |
| Stall prevention | 22 | H500 | Stall prevention operation level | 0 to 400% | 0.1% | 120% | 110% | |
| | 23 | H610 | Stall prevention operation level compensation factor at double speed | 0 to 200%, 9999 | 0.1% | 9999 | | |
| Multi-speed setting | 24 to 27 | D304 to D307 | Multi-speed setting (4 speed to 7 speed) | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | |
| – | 28 | D300 | Multi-speed input compensation selection | 0, 1 | 1 | 0 | | |
| – | 29 | F100 | Acceleration/deceleration pattern selection | 0 to 3, 6 | 1 | 0 | | |

| Function | Pr. | Pr. group | Name | Setting range | Minimum setting increments | Initial value FM | Initial value CA | Customer setting |
|---|---|---|---|---|---|---|---|---|
| — | 30 | E300 | Regenerative function selection | 0 to 2, 10, 11, 20, 21, 100 to 102, 110, 111, 120, 121 *10 | 1 | 0 | | |
| | | | | 2, 10, 11, 102, 110, 111 *11 | 1 | 10 | | |
| Frequency jump | 31 | H420 | Frequency jump 1A | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | |
| | 32 | H421 | Frequency jump 1B | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | |
| | 33 | H422 | Frequency jump 2A | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | |
| | 34 | H423 | Frequency jump 2B | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | |
| | 35 | H424 | Frequency jump 3A | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | |
| | 36 | H425 | Frequency jump 3B | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | |
| — | 37 | M000 | Speed display | 0, 1 to 9998 | 1 | 0 | | |
| Frequency detection | 41 | M441 | Up-to-frequency sensitivity | 0 to 100% | 0.1% | 10% | | |
| | 42 | M442 | Output frequency detection | 0 to 590 Hz | 0.01 Hz | 6 Hz | | |
| | 43 | M443 | Output frequency detection for reverse rotation | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | |
| Second functions | 44 | F020 | Second acceleration/deceleration time | 0 to 3600 s | 0.1 s | 5 s | | |
| | 45 | F021 | Second deceleration time | 0 to 3600 s, 9999 | 0.1 s | 9999 | | |
| | 46 | G010 | Second torque boost | 0 to 30%, 9999 | 0.1% | 9999 | | |
| | 47 | G011 | Second V/F (base frequency) | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | |
| | 48 | H600 | Second stall prevention operation level | 0 to 400% | 0.1% | 120% | 110% | |
| | 49 | H601 | Second stall prevention operation frequency | 0 to 590 Hz, 9999 | 0.01 Hz | 0 Hz | | |
| | 50 | M444 | Second output frequency detection | 0 to 590 Hz | 0.01 Hz | 30 Hz | | |
| | 51 | H010 C203 | Second electronic thermal O/L relay Rated second motor current | 0 to 500 A, 9999 *2 | 0.01 A | 9999 | | |
| | | | | 0 to 3600 A, 9999 *3 | 0.1 A | | | |
| Monitor functions | 52 | M100 | Operation panel main monitor selection | 0, 5 to 14, 17, 18, 20, 23 to 25, 34, 38, 40 to 45, 50 to 57, 61, 62, 64, 67, 68, 81 to 96, 98, 100 | 1 | 0 | | |
| | 54 | M300 | FM/CA terminal function selection | 1 to 3, 5 to 14, 17, 18, 21, 24, 34, 50, 52, 53, 61, 62, 67, 70, 85, 87 to 90, 92, 93, 95, 98 | 1 | 1 | | |
| | 55 | M040 | Frequency monitoring reference | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | |
| | 56 | M041 | Current monitoring reference | 0 to 500 A *2 | 0.01 A | Rated inverter current | | |
| | | | | 0 to 3600 A *3 | 0.1 A | | | |
| Automatic restart | 57 | A702 | Restart coasting time | 0, 0.1 to 30 s, 9999 | 0.1 s | 9999 | | |
| | 58 | A703 | Restart cushion time | 0 to 60 s | 0.1 s | 1 s | | |
| — | 59 | F101 | Remote function selection | 0 to 3, 11 to 13 | 1 | 0 | | |
| — | 60 | G030 | Energy saving control selection | 0, 4, 9 | 1 | 0 | | |
| — | 65 | H300 | Retry selection | 0 to 5 | 1 | 0 | | |
| — | 66 | H611 | Stall prevention operation reduction starting frequency | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | |
| Retry | 67 | H301 | Number of retries at fault occurrence | 0 to 10, 101 to 110 | 1 | 0 | | |
| | 68 | H302 | Retry waiting time | 0.1 to 600 s | 0.1 s | 1 s | | |
| | 69 | H303 | Retry count display erase | 0 | 1 | 0 | | |
| — | 70 | G107 | Parameter for manufacturer setting. Do not set. | | | | | |
| — | 71 | C100 | Applied motor | 0 to 6, 13 to 16, 20, 23, 24, 40, 43, 44, 50, 53, 54, 70, 73, 74, 210, 213, 214, 8090, 8093, 8094, 9090, 9093, 9094 | 1 | 0 | | |
| — | 72 | E600 | PWM frequency selection | 0 to 15 *2 | 1 | 2 | | |
| — | | | | 0 to 6, 25 *3 | | | | |
| — | 73 | T000 | Analog input selection | 0 to 7, 10 to 17 | 1 | 1 | | |
| — | 74 | T002 | Input filter time constant | 0 to 8 | 1 | 1 | | |

| Function | Pr. | Pr. group | Name | Setting range | Minimum setting increments | Initial value FM | Initial value CA | Customer setting |
|---|---|---|---|---|---|---|---|---|
| — | 75 | - | Reset selection/disconnected PU detection/ PU stop selection | 0 to 3, 14 to 17 *2 / 0 to 3, 14 to 17, 100 to 103, 114 to 117 *3 | 1 | 14 | | |
| | | E100 | Reset selection | 0, 1 | | 0 | | |
| | | E101 | Disconnected PU detection | | | | | |
| | | E102 | PU stop selection | | | 1 | | |
| | | E107 | Reset limit | 0 *2 / 0, 1 *3 | 1 | 0 | | |
| — | 76 | M510 | Fault code output selection | 0 to 2 | 1 | 0 | | |
| — | 77 | E400 | Parameter write selection | 0 to 2 | 1 | 0 | | |
| — | 78 | D020 | Reverse rotation prevention selection | 0 to 2 | 1 | 0 | | |
| — | 79 | D000 | Operation mode selection (Simple) | 0 to 4, 6, 7 | 1 | 0 | | |
| Motor constants | 80 | C101 | Motor capacity | 0.4 to 55 kW, 9999 *2 / 0 to 3600 kW, 9999 *3 | 0.01 kW *2 / 0.1 kW *3 | 9999 | | |
| | 81 | C102 | Number of motor poles | 2, 4, 6, 8, 10, 12, 9999 | 1 | 9999 | | |
| | 82 | C125 | Motor excitation current | 0 to 500 A, 9999 *2 / 0 to 3600 A, 9999 *3 | 0.01 A *2 / 0.1 A *3 | 9999 | | |
| | 83 | C104 | Rated motor voltage | 0 to 1000 V | 0.1 V | 200 V *7 / 400 V *8 | | |
| | 84 | C105 | Rated motor frequency | 10 to 400 Hz, 9999 | 0.01 Hz | 9999 | | |
| | 89 | G932 | Speed control gain (Advanced magnetic flux vector) | 0 to 200%, 9999 | 0.1% | 9999 | | |
| | 90 | C120 | Motor constant (R1) | 0 to 50 Ω, 9999 *2 / 0 to 400 mΩ, 9999 *3 | 0.001 Ω *2 / 0.01 mΩ *3 | 9999 | | |
| | 91 | C121 | Motor constant (R2) | 0 to 50 Ω, 9999 *2 / 0 to 400 mΩ, 9999 *3 | 0.001 Ω *2 / 0.01 mΩ *3 | 9999 | | |
| | 92 | C122 | Motor constant (L1)/d-axis inductance (Ld) | 0 to 6000mH, 9999 *2 / 0 to 400mH, 9999 *3 | 0.1 mH *2 / 0.01 mH *3 | 9999 | | |
| | 93 | C123 | Motor constant (L2)/q-axis inductance (Lq) | 0 to 6000mH, 9999 *2 / 0 to 400mH, 9999 *3 | 0.1 mH *2 / 0.01 mH *3 | 9999 | | |
| | 94 | C124 | Motor constant (X) | 0 to 100%, 9999 | 0.1% *2 / 0.01% *3 | 9999 | | |
| | 95 | C111 | Online auto tuning selection | 0, 1 | 1 | 0 | | |
| | 96 | C110 | Auto tuning setting/status | 0, 1, 11, 101 | 1 | 0 | | |
| Adjustable 5 points V/F | 100 | G040 | V/F1 (first frequency) | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | |
| | 101 | G041 | V/F1 (first frequency voltage) | 0 to 1000 V | 0.1 V | 0 V | | |
| | 102 | G042 | V/F2 (second frequency) | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | |
| | 103 | G043 | V/F2 (second frequency voltage) | 0 to 1000 V | 0.1 V | 0 V | | |
| | 104 | G044 | V/F3 (third frequency) | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | |
| | 105 | G045 | V/F3 (third frequency voltage) | 0 to 1000 V | 0.1 V | 0 V | | |
| | 106 | G046 | V/F4 (fourth frequency) | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | |
| | 107 | G047 | V/F4 (fourth frequency voltage) | 0 to 1000 V | 0.1 V | 0 V | | |
| | 108 | G048 | V/F5 (fifth frequency) | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | |
| | 109 | G049 | V/F5 (fifth frequency voltage) | 0 to 1000 V | 0.1 V | 0 V | | |
| PU connector communication | 117 | N020 | PU communication station number | 0 to 31 | 1 | 0 | | |
| | 118 | N021 | PU communication speed | 48, 96, 192, 384, 576, 768, 1152 | 1 | 192 | | |
| | 119 | - | PU communication stop bit length / data length | 0, 1, 10, 11 | 1 | 1 | | |
| | | N022 | PU communication data length | 0, 1 | | 0 | | |
| | | N023 | PU communication stop bit length | 0, 1 | | 1 | | |
| | 120 | N024 | PU communication parity check | 0 to 2 | 1 | 2 | | |
| | 121 | N025 | Number of PU communication retries | 0 to 10, 9999 | 1 | 1 | | |
| | 122 | N026 | PU communication check time interval | 0, 0.1 to 999.8 s, 9999 | 0.1 s | 9999 | | |
| | 123 | N027 | PU communication waiting time setting | 0 to 150 ms, 9999 | 1 ms | 9999 | | |
| | 124 | N028 | PU communication CR/LF selection | 0 to 2 | 1 | 1 | | |
| — | 125 | T022 | Terminal 2 frequency setting gain frequency (Simple) | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | |
| — | 126 | T042 | Terminal 4 frequency setting gain frequency (Simple) | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | |

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| Function | Pr. | Pr. group | Name | Setting range | Minimum setting increments | Initial value | | Customer setting |
|---|---|---|---|---|---|---|---|---|
| | | | | | | FM | CA | |
| PID operation | 127 | A612 | PID control automatic switchover frequency | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | |
| | 128 | A610 | PID action selection | 0, 10, 11, 20, 21, 50, 51, 60, 61, 70, 71, 80, 81, 90, 91, 100, 101, 1000, 1001, 1010, 1011, 2000, 2001, 2010, 2011 | 1 | 0 | | |
| | 129 | A613 | PID proportional band | 0.1 to 1000%, 9999 | 0.1% | 100% | | |
| | 130 | A614 | PID integral time | 0.1 to 3600 s, 9999 | 0.1 s | 1 s | | |
| | 131 | A601 | PID upper limit | 0 to 100%, 9999 | 0.1% | 9999 | | |
| | 132 | A602 | PID lower limit | 0 to 100%, 9999 | 0.1% | 9999 | | |
| | 133 | A611 | PID action set point | 0 to 100%, 9999 | 0.01% | 9999 | | |
| | 134 | A615 | PID differential time | 0.01 to 10 s, 9999 | 0.01 s | 9999 | | |
| Bypass | 135 | A000 | Electronic bypass sequence selection | 0, 1 | 1 | 0 | | |
| | 136 | A001 | MC switchover interlock time | 0 to 100 s | 0.1 s | 1 s | | |
| | 137 | A002 | Start waiting time | 0 to 100 s | 0.1 s | 0.5 s | | |
| | 138 | A003 | Bypass selection at a fault | 0, 1 | 1 | 0 | | |
| | 139 | A004 | Automatic switchover frequency from inverter to bypass operation | 0 to 60 Hz, 9999 | 0.01 Hz | 9999 | | |
| Backlash measures | 140 | F200 | Backlash acceleration stopping frequency | 0 to 590 Hz | 0.01 Hz | 1 Hz | | |
| | 141 | F201 | Backlash acceleration stopping time | 0 to 360 s | 0.1 s | 0.5 s | | |
| | 142 | F202 | Backlash deceleration stopping frequency | 0 to 590 Hz | 0.01 Hz | 1 Hz | | |
| | 143 | F203 | Backlash deceleration stopping time | 0 to 360 s | 0.1 s | 0.5 s | | |
| — | 144 | M002 | Speed setting switchover | 0, 2, 4, 6, 8, 10, 12, 102, 104, 106, 108, 110, 112 | 1 | 4 | | |
| PU | 145 | E103 | PU display language selection | 0 to 7 | 1 | 1 | | |
| — | 147 | F022 | Acceleration/deceleration time switching frequency | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | |
| Current detection | 148 | H620 | Stall prevention level at 0 V input | 0 to 400% | 0.1% | 120% | 110% | |
| | 149 | H621 | Stall prevention level at 10 V input | 0 to 400% | 0.1% | 150% | 120% | |
| | 150 | M460 | Output current detection level | 0 to 400% | 0.1% | 120% | 110% | |
| | 151 | M461 | Output current detection signal delay time | 0 to 10 s | 0.1 s | 0 s | | |
| | 152 | M462 | Zero current detection level | 0 to 400% | 0.1% | 5% | | |
| | 153 | M463 | Zero current detection time | 0 to 10 s | 0.01 s | 0.5 s | | |
| — | 154 | H631 | Voltage reduction selection during stall prevention operation | 0, 1, 10, 11 | 1 | 1 | | |
| — | 155 | T730 | RT signal function validity condition selection | 0, 10 | 1 | 0 | | |
| — | 156 | H501 | Stall prevention operation selection | 0 to 31, 100, 101 | 1 | 0 | | |
| — | 157 | M430 | OL signal output timer | 0 to 25 s, 9999 | 0.1 s | 0 s | | |
| — | 158 | M301 | AM terminal function selection | 1 to 3, 5 to 14, 17, 18, 21, 24, 34, 50, 52 to 54, 61, 62, 67, 70, 86 to 96, 98 | 1 | 1 | | |
| — | 159 | A005 | Automatic switchover frequency range from bypass to inverter operation | 0 to 10 Hz, 9999 | 0.01 Hz | 9999 | | |
| — | 160 | E440 | User group read selection *Simple* | 0, 1, 9999 | 1 | 9999 | 0 | |
| — | 161 | E200 | Frequency setting/key lock operation selection | 0, 1, 10, 11 | 1 | 0 | | |
| Automatic restart functions | 162 | A700 | Automatic restart after instantaneous power failure selection | 0 to 3, 10 to 13 | 1 | 0 | | |
| | 163 | A704 | First cushion time for restart | 0 to 20 s | 0.1 s | 0 s | | |
| | 164 | A705 | First cushion voltage for restart | 0 to 100% | 0.1% | 0% | | |
| | 165 | A710 | Stall prevention operation level for restart | 0 to 400% | 0.1% | 120% | 110% | |
| Current detection | 166 | M433 | Output current detection signal retention time | 0 to 10 s, 9999 | 0.1 s | 0.1 s | | |
| | 167 | M464 | Output current detection operation selection | 0, 1, 10, 11 | 1 | 0 | | |
| — | 168 | E000 / E080 | Parameter for manufacturer setting. Do not set. | | | | | |
| — | 169 | E001 / E081 | | | | | | |
| Cumulative monitor clear | 170 | M020 | Watt-hour meter clear | 0, 10, 9999 | 1 | 9999 | | |
| | 171 | M030 | Operation hour meter clear | 0, 9999 | 1 | 9999 | | |

| Function | Pr. | Pr. group | Name | Setting range | Minimum setting increments | Initial value FM | Initial value CA | Customer setting |
|---|---|---|---|---|---|---|---|---|
| User group | 172 | E441 | User group registered display/batch clear | 9999, (0 to 16) | 1 | 0 | | |
| User group | 173 | E442 | User group registration | 0 to 1999, 9999 | 1 | 9999 | | |
| User group | 174 | E443 | User group clear | 0 to 1999, 9999 | 1 | 9999 | | |
| Input terminal function assignment | 178 | T700 | STF terminal function selection | 0 to 8, 10 to 14, 16, 18, 24, 25, 28, 37 to 40, 46 to 48, 50, 51, 60, 62, 64 to 67, 70 to 73, 77 to 81, 84, 94 to 98, 9999 | 1 | 60 | | |
| Input terminal function assignment | 179 | T701 | STR terminal function selection | 0 to 8, 10 to 14, 16, 18, 24, 25, 28, 37 to 40, 46 to 48, 50, 51, 61, 62, 64 to 67, 70 to 73, 77 to 81, 84, 94 to 98, 9999 | 1 | 61 | | |
| Input terminal function assignment | 180 | T702 | RL terminal function selection | 0 to 8, 10 to 14, 16, 18, 24, 25, 28, 37 to 40, 46 to 48, 50, 51, 62, 64 to 67, 70 to 73, 77 to 81, 84, 94 to 98, 9999 | 1 | 0 | | |
| Input terminal function assignment | 181 | T703 | RM terminal function selection | | 1 | 1 | | |
| Input terminal function assignment | 182 | T704 | RH terminal function selection | | 1 | 2 | | |
| Input terminal function assignment | 183 | T705 | RT terminal function selection | | 1 | 3 | | |
| Input terminal function assignment | 184 | T706 | AU terminal function selection | | 1 | 4 | | |
| Input terminal function assignment | 185 | T707 | JOG terminal function selection | | 1 | 5 | | |
| Input terminal function assignment | 186 | T708 | CS terminal function selection | | 1 | 9999 | | |
| Input terminal function assignment | 187 | T709 | MRS terminal function selection | | 1 | 24 *10 / 10 *11 | | |
| Input terminal function assignment | 188 | T710 | STOP terminal function selection | | 1 | 25 | | |
| Input terminal function assignment | 189 | T711 | RES terminal function selection | | 1 | 62 | | |
| Output terminal function assignment | 190 | M400 | RUN terminal function selection | 0 to 5, 7, 8, 10 to 19, 25, 26, 35, 39, 40, 45 to 54, 57, 64 to 68, 70 to 79, 82, 85, 90 to 96, 98 to 105, 107, 108, 110 to 116, 125, 126, 135, 139, 140, 145 to 154, 157, 164 to 168, 170 to 179, 182, 185, 190 to 196, 198 to 208, 211 to 213, 215, 300 to 308, 311 to 313, 315, 9999 | 1 | 0 | | |
| Output terminal function assignment | 191 | M401 | SU terminal function selection | | 1 | 1 | | |
| Output terminal function assignment | 192 | M402 | IPF terminal function selection | | 1 | 2 *10 / 9999 *11 | | |
| Output terminal function assignment | 193 | M403 | OL terminal function selection | | 1 | 3 | | |
| Output terminal function assignment | 194 | M404 | FU terminal function selection | | 1 | 4 | | |
| Output terminal function assignment | 195 | M405 | ABC1 terminal function selection | 0 to 5, 7, 8, 10 to 19, 25, 26, 35, 39, 40, 45 to 54, 57, 64 to 68, 70 to 79, 82, 85, 90, 91, 94 to 96, 98 to 105, 107, 108, 110 to 116, 125, 126, 135, 139, 140, 145 to 154, 157, 164 to 168, 170 to 179, 182, 185, 190, 191, 194 to 196, 198 to 208, 211 to 213, 215, 300 to 308, 311 to 313, 315, 9999 | 1 | 99 | | |
| Output terminal function assignment | 196 | M406 | ABC2 terminal function selection | | 1 | 9999 | | |
| Multi-speed setting | 232 to 239 | D308 to D315 | Multi-speed setting (8 speed to 15 speed) | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | |
| — | 240 | E601 | Soft-PWM operation selection | 0, 1 | 1 | 1 | | |
| — | 241 | M043 | Analog input display unit switchover | 0, 1 | 1 | 0 | | |
| — | 242 | T021 | Terminal 1 added compensation amount (terminal 2) | 0 to 100% | 0.1% | 100% | | |
| — | 243 | T041 | Terminal 1 added compensation amount (terminal 4) | 0 to 100% | 0.1% | 75% | | |
| — | 244 | H100 | Cooling fan operation selection | 0, 1, 101 to 105 | 1 | 1 | | |

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| Function | Pr. | Pr. group | Name | Setting range | Minimum setting increments | Initial value FM | Initial value CA | Customer setting |
|---|---|---|---|---|---|---|---|---|
| Slip compensation | 245 | G203 | Rated slip | 0 to 50%, 9999 | 0.01% | 9999 | | |
| | 246 | G204 | Slip compensation time constant | 0.01 to 10 s | 0.01 s | 0.5 s | | |
| | 247 | G205 | Constant-power range slip compensation selection | 0, 9999 | 1 | 9999 | | |
| — | 248 | A006 | Self power management selection | 0 to 2 | 1 | 0 | | |
| — | 249 | H101 | Earth (ground) fault detection at start | 0, 1 | 1 | 0 | | |
| — | 250 | G106 | Stop selection | 0 to 100 s, 1000 to 1100 s, 8888, 9999 | 0.1 s | 9999 | | |
| — | 251 | H200 | Output phase loss protection selection | 0, 1 | 1 | 1 | | |
| Frequency compensation function | 252 | T050 | Override bias | 0 to 200% | 0.1% | 50% | | |
| | 253 | T051 | Override gain | 0 to 200% | 0.1% | 150% | | |
| — | 254 | A007 | Main circuit power OFF waiting time | 0 to 3600 s, 9999 | 1 s | 600 s | | |
| Life check | 255 | E700 | Life alarm status display | (0 to 15) | 1 | 0 | | |
| | 256 *12 | E701 | Inrush current limit circuit life display | (0 to 100%) | 1% | 100% | | |
| | 257 | E702 | Control circuit capacitor life display | (0 to 100%) | 1% | 100% | | |
| | 258 *12 | E703 | Main circuit capacitor life display | (0 to 100%) | 1% | 100% | | |
| | 259 *12 | E704 | Main circuit capacitor life measuring | 0, 1 | 1 | 0 | | |
| — | 260 | E602 | PWM frequency automatic switchover | 0, 1 | 1 | 1 | | |
| Power failure stop | 261 | A730 | Power failure stop selection | 0 to 2, 11, 12, 21, 22 | 1 | 0 | | |
| | 262 | A731 | Subtracted frequency at deceleration start | 0 to 20 Hz | 0.01 Hz | 3 Hz | | |
| | 263 | A732 | Subtraction starting frequency | 0 to 590 Hz, 9999 | 0.01 Hz | 60 Hz | 50 Hz | |
| | 264 | A733 | Power-failure deceleration time 1 | 0 to 3600 s | 0.1 s | 5 s | | |
| | 265 | A734 | Power-failure deceleration time 2 | 0 to 3600 s, 9999 | 0.1 s | 9999 | | |
| | 266 | A735 | Power failure deceleration time switchover frequency | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | |
| — | 267 | T001 | Terminal 4 input selection | 0 to 2 | 1 | 0 | | |
| — | 268 | M022 | Monitor decimal digits selection | 0, 1, 9999 | 1 | 9999 | | |
| — | 269 | E023 | Parameter for manufacturer setting. Do not set. | | | | | |
| — | 289 | M431 | Inverter output terminal filter | 5 to 50 ms, 9999 | 1 ms | 9999 | | |
| — | 290 | M044 | Monitor negative output selection | 0 to 7 | 1 | 0 | | |
| — | 291 | D100 | Pulse train I/O selection | [FM Type] 0, 1, 10, 11, 20, 21, 100 [CA Type] 0, 1 | 1 | 0 | | |
| — | 294 | A785 | UV avoidance voltage gain | 0 to 200% | 0.1% | 100% | | |
| — | 295 | E201 | Frequency change increment amount setting | 0, 0.01, 0.1, 1, 10 | 0.01 | 0 | | |
| Password function | 296 | E410 | Password lock level | 0 to 6, 99, 100 to 106, 199, 9999 | 1 | 9999 | | |
| | 297 | E411 | Password lock/unlock | (0 to 5), 1000 to 9998, 9999 | 1 | 9999 | | |
| — | 298 | A711 | Frequency search gain | 0 to 32767, 9999 | 1 | 9999 | | |
| — | 299 | A701 | Rotation direction detection selection at restarting | 0, 1, 9999 | 1 | 9999 | | |

| Function | Pr. | Pr. group | Name | Setting range | Minimum setting increments | Initial value FM | CA | Customer setting |
|---|---|---|---|---|---|---|---|---|
| RS-485 communication | 331 | N030 | RS-485 communication station number | 0 to 31 (0 to 247) | 1 | 0 | | |
| | 332 | N031 | RS-485 communication speed | 3, 6, 12, 24, 48, 96, 192, 384, 576, 768, 1152 | 1 | 96 | | |
| | 333 | - | RS-485 communication stop bit length / data length | 0, 1, 10, 11 | 1 | 1 | | |
| | | N032 | PU communication data length | 0, 1 | 1 | 0 | | |
| | | N033 | PU communication stop bit length | 0, 1 | 1 | 1 | | |
| | 334 | N034 | RS-485 communication parity check selection | 0 to 2 | 1 | 2 | | |
| | 335 | N035 | RS-485 communication retry count | 0 to 10, 9999 | 1 | 1 | | |
| | 336 | N036 | RS-485 communication check time interval | 0 to 999.8 s, 9999 | 0.1 s | 0 s | | |
| | 337 | N037 | RS-485 communication waiting time setting | 0 to 150 ms, 9999 | 1 ms | 9999 | | |
| | 338 | D010 | Communication operation command source | 0, 1 | 1 | 0 | | |
| | 339 | D011 | Communication speed command source | 0 to 2 | 1 | 0 | | |
| | 340 | D001 | Communication startup mode selection | 0 to 2, 10, 12 | 1 | 0 | | |
| | 341 | N038 | RS-485 communication CR/LF selection | 0 to 2 | 1 | 1 | | |
| | 342 | N001 | Communication EEPROM write selection | 0, 1 | 1 | 0 | | |
| | 343 | N080 | Communication error count | — | 1 | 0 | | |
| — | 374 | H800 | Overspeed detection level | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | |
| Pulse train input | 384 | D101 | Input pulse division scaling factor | 0 to 250 | 1 | 0 | | |
| | 385 | D110 | Frequency for zero input pulse | 0 to 590 Hz | 0.01 Hz | 0 Hz | | |
| | 386 | D111 | Frequency for maximum input pulse | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | |
| — | 390 | N054 | % setting reference frequency | 1 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | |
| PLC function | 414 | A800 | PLC function operation selection | 0 to 2 | 1 | 0 | | |
| | 415 | A801 | Inverter operation lock mode setting | 0, 1 | 1 | 0 | | |
| | 416 | A802 | Pre-scale function selection | 0 to 5 | 1 | 0 | | |
| | 417 | A803 | Pre-scale setting value | 0 to 32767 | 1 | 1 | | |
| Second motor constants | 450 | C200 | Second applied motor | 0, 1, 3 to 6, 13 to 16, 20, 23, 24, 40, 43, 44, 50, 53, 54, 70, 73, 74, 210, 213, 214, 8093, 8094, 9090, 9093, 9094, 9999 | 1 | 9999 | | |
| | 453 | C201 | Second motor capacity | 0.4 to 55 kW, 9999 *2 / 0 to 3600 kW, 9999 *3 | 0.01 kW *2 / 0.1 kW *3 | 9999 | | |
| | 454 | C202 | Number of second motor poles | 2, 4, 6, 8, 10, 12, 9999 | 1 | 9999 | | |
| | 455 | C225 | Second motor excitation current | 0 to 500 A, 9999 *2 / 0 to 3600 A, 9999 *3 | 0.01 A *2 / 0.1 A *3 | 9999 | | |
| | 456 | C204 | Rated second motor voltage | 0 to 1000 V | 0.1 V | 200 V / 400 V | | |
| | 457 | C205 | Rated second motor frequency | 10 to 400 Hz, 9999 | 0.01 Hz | 9999 | | |
| | 458 | C220 | Second motor constant (R1) | 0 to 50 Ω, 9999 *2 / 0 to 400 mΩ, 9999 *3 | 0.001 Ω *2 / 0.01 mΩ *3 | 9999 | | |
| | 459 | C221 | Second motor constant (R2) | 0 to 50 Ω, 9999 *2 / 0 to 400 mΩ, 9999 *3 | 0.001 Ω *2 / 0.01 mΩ *3 | 9999 | | |
| | 460 | C222 | Second motor constant (L1) / d-axis inductance (Ld) | 0 to 6000mH, 9999 *2 / 0 to 400mH, 9999 *3 | 0.1 mH *2 / 0.01 mH *3 | 9999 | | |
| | 461 | C223 | Second motor constant (L2) / q-axis inductance (Lq) | 0 to 6000mH, 9999 *2 / 0 to 400mH, 9999 *3 | 0.1 mH *2 / 0.01 mH *3 | 9999 | | |
| | 462 | C224 | Second motor constant (X) | 0 to 100%, 9999 | 0.1% *2 / 0.01% *3 | 9999 | | |
| | 463 | C210 | Second motor auto tuning setting/status | 0, 1, 11, 101 | 1 | 0 | | |
| Remote output | 495 | M500 | Remote output selection | 0, 1, 10, 11 | 1 | 0 | | |
| | 496 | M501 | Remote output data 1 | 0 to 4095 | 1 | 0 | | |
| | 497 | M502 | Remote output data 2 | 0 to 4095 | 1 | 0 | | |
| — | 498 | A804 | PLC function flash memory clear | 0 to 9999 | 1 | 0 | | |
| — | 502 | N013 | Stop mode selection at communication error | 0 to 3 | 1 | 0 | | |
| Maintenance | 503 | E710 | Maintenance timer 1 | 0 (1 to 9998) | 1 | 0 | | |
| | 504 | E711 | Maintenance timer 1 warning output set time | 0 to 9998, 9999 | 1 | 9999 | | |
| — | 505 | M001 | Speed setting reference | 1 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | |
| — | 514 *12 | H324 | Emergency drive dedicated retry waiting time | 0.1 to 600 s, 9999 | 0.1 s | 9999 | | |
| — | 515 *12 | H322 | Emergency drive dedicated retry count | 1 to 200, 9999 | 1 | 1 | | |

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|---|---|---|---|---|---|---|---|---|
| – | 522 | G105 | Output stop frequency | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | |
| – | 523 *12 | H320 | Emergency drive mode selection | 100, 111, 112, 121 to 124, 200, 211, 212, 221 to 224, 300, 311, 312, 321 to 324, 400, 411, 412, 421 to 424, 9999 | 1 | 9999 | | |
| – | 524 *12 | H321 | Emergency drive running speed | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | |
| – | 539 | N002 | Modbus-RTU communication check time interval | 0 to 999.8 s, 9999 | 0.1 s | 9999 | | |
| USB | 547 | N040 | USB communication station number | 0 to 31 | 1 | 0 | | |
| USB | 548 | N041 | USB communication check time interval | 0 to 999.8 s, 9999 | 0.1 s | 9999 | | |
| Communication | 549 | N000 | Protocol selection | 0, 1, 2 | 1 | 0 | | |
| Communication | 550 | D012 | NET mode operation command source selection | 0, 1, 9999 | 1 | 9999 | | |
| Communication | 551 | D013 | PU mode operation command source selection | 1 to 3, 9999 | 1 | 9999 | | |
| – | 552 | H429 | Frequency jump range | 0 to 30 Hz, 9999 | 0.01 Hz | 9999 | | |
| PID control | 553 | A603 | PID deviation limit | 0 to 100%, 9999 | 0.1% | 9999 | | |
| PID control | 554 | A604 | PID signal operation selection | 0 to 3, 10 to 13 | 1 | 0 | | |
| Current average value monitor | 555 | E720 | Current average time | 0.1 to 1 s | 0.1 s | 1 s | | |
| Current average value monitor | 556 | E721 | Data output mask time | 0 to 20 s | 0.1 s | 0 s | | |
| Current average value monitor | 557 | E722 | Current average value monitor signal output reference current | 0 to 500 A*2 / 0 to 3600 A*3 | 0.01 A *2 / 0.1 A *3 | Rated inverter current | | |
| – | 560 | A712 | Second frequency search gain | 0 to 32767, 9999 | 1 | 9999 | | |
| – | 561 | H020 | PTC thermistor protection level | 0.5 to 30 kΩ, 9999 | 0.01 kΩ | 9999 | | |
| – | 563 | M021 | Energization time carrying-over times | (0 to 65535) | 1 | 0 | | |
| – | 564 | M031 | Operating time carrying-over times | (0 to 65535) | 1 | 0 | | |
| Second motor constants | 569 | G942 | Second motor speed control gain | 0 to 200%, 9999 | 0.1% | 9999 | | |
| Multiple rating | 570 | E301 | Multiple rating setting | 0, 1 | 1 | 1 | 0 | |
| – | 571 | F103 | Holding time at a start | 0 to 10 s, 9999 | 0.1 s | 9999 | | |
| – | 573 | A680 / T052 | 4 mA input check selection | 1 to 4, 9999 | 1 | 9999 | | |
| – | 574 | C211 | Second motor online auto tuning | 0, 1 | 1 | 0 | | |
| PID control | 575 | A621 | Output interruption detection time | 0 to 3600 s, 9999 | 0.1 s | 1 s | | |
| PID control | 576 | A622 | Output interruption detection level | 0 to 590 Hz | 0.01 Hz | 0 Hz | | |
| PID control | 577 | A623 | Output interruption cancel level | 900 to 1100% | 0.1% | 1000% | | |
| Multi-pump function | 578 | A400 | Auxiliary motor operation selection | 0 to 3 | 1 | 0 | | |
| Multi-pump function | 579 | A401 | Motor connection function selection | 0 to 3 | 1 | 0 | | |
| Multi-pump function | 580 | A402 | MC switching interlock time | 0 to 100 s | 0.1 s | 1 s | | |
| Multi-pump function | 581 | A403 | Start waiting time | 0 to 100 s | 0.1 s | 1 s | | |
| Multi-pump function | 582 | A404 | Auxiliary motor connection-time deceleration time | 0 to 3600 s, 9999 | 0.1 s | 1 s | | |
| Multi-pump function | 583 | A405 | Auxiliary motor disconnection-time acceleration time | 0 to 3600 s, 9999 | 0.1 s | 1 s | | |
| Multi-pump function | 584 | A406 | Auxiliary motor 1 starting frequency | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | |
| Multi-pump function | 585 | A407 | Auxiliary motor 2 starting frequency | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | |
| Multi-pump function | 586 | A408 | Auxiliary motor 3 starting frequency | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | |
| Multi-pump function | 587 | A409 | Auxiliary motor 1 stopping frequency | 0 to 590 Hz | 0.01 Hz | 0 Hz | | |
| Multi-pump function | 588 | A410 | Auxiliary motor 2 stopping frequency | 0 to 590 Hz | 0.01 Hz | 0 Hz | | |
| Multi-pump function | 589 | A411 | Auxiliary motor 3 stopping frequency | 0 to 590 Hz | 0.01 Hz | 0 Hz | | |
| Multi-pump function | 590 | A412 | Auxiliary motor start detection time | 0 to 3600 s | 0.1 s | 5 s | | |
| Multi-pump function | 591 | A413 | Auxiliary motor stop detection time | 0 to 3600 s | 0.1 s | 5 s | | |

| Function | Pr. | Pr. group | Name | Setting range | Minimum setting increments | Initial value | | Customer setting |
|---|---|---|---|---|---|---|---|---|
| | | | | | | FM | CA | |
| Traverse function | 592 | A300 | Traverse function selection | 0 to 2 | 1 | 0 | | |
| | 593 | A301 | Maximum amplitude amount | 0 to 25% | 0.1% | 10% | | |
| | 594 | A302 | Amplitude compensation amount during deceleration | 0 to 50% | 0.1% | 10% | | |
| | 595 | A303 | Amplitude compensation amount during acceleration | 0 to 50% | 0.1% | 10% | | |
| | 596 | A304 | Amplitude acceleration time | 0.1 to 3600 s | 0.1 s | 5 s | | |
| | 597 | A305 | Amplitude deceleration time | 0.1 to 3600 s | 0.1 s | 5 s | | |
| — | 598 *13 | H102 | Undervoltage level | 350 to 430 V, 9999 | 0.1 V | 9999 | | |
| — | 599 | T721 | X10 terminal input selection | 0, 1 | 1 | 0 *10 / 1 *11 | | |
| Electronic thermal O/L relay | 600 | H001 | First free thermal reduction frequency 1 | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | |
| | 601 | H002 | First free thermal reduction ratio 1 | 1 to 100% | 1% | 100% | | |
| | 602 | H003 | First free thermal reduction frequency 2 | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | |
| | 603 | H004 | First free thermal reduction ratio 2 | 1 to 100% | 1% | 100% | | |
| | 604 | H005 | First free thermal reduction frequency 3 | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | |
| — | 606 | T722 | Power failure stop external signal input selection | 0, 1 | 1 | 1 | | |
| — | 607 | H006 | Motor permissible load level | 110 to 250% | 1% | 150% | | |
| — | 608 | H016 | Second motor permissible load level | 110 to 250%, 9999 | 1% | 9999 | | |
| PID control | 609 | A624 | PID set point/deviation input selection | 1 to 5 | 1 | 2 | | |
| | 610 | A625 | PID measured value input selection | 1 to 5, 101 to 105 | 1 | 3 | | |
| — | 611 | F003 | Acceleration time at a restart | 0 to 3600 s, 9999 | 0.1 s | 9999 | | |
| Speed smoothing control | 653 | G410 | Speed smoothing control | 0 to 200% | 0.1% | 0% | | |
| | 654 | G411 | Speed smoothing cutoff frequency | 0 to 120 Hz | 0.01 Hz | 20 Hz | | |
| Analog remote output function | 655 | M530 | Analog remote output selection | 0, 1, 10, 11 | 1 | 0 | | |
| | 656 | M531 | Analog remote output 1 | 800 to 1200% | 0.1% | 1000% | | |
| | 657 | M532 | Analog remote output 2 | 800 to 1200% | 0.1% | 1000% | | |
| | 658 | M533 | Analog remote output 3 | 800 to 1200% | 0.1% | 1000% | | |
| | 659 | M534 | Analog remote output 4 | 800 to 1200% | 0.1% | 1000% | | |
| Increased magnetic excitation deceleration | 660 | G130 | Increased magnetic excitation deceleration operation selection | 0, 1 | 1 | 0 | | |
| | 661 | G131 | Magnetic excitation increase rate | 0 to 40%, 9999 | 0.1% | 9999 | | |
| | 662 | G132 | Increased magnetic excitation current level | 0 to 300% | 0.1% | 100% | | |
| — | 663 | M060 | Control circuit temperature signal output level | 0 to 100°C | 1°C | 0°C | | |
| — | 665 | G125 | Regeneration avoidance frequency gain | 0 to 200% | 0.1% | 100% | | |
| — | 668 | A786 | Power failure stop frequency gain | 0 to 200% | 0.1% | 100% | | |
| — | 673 | G060 | SF-PR slip amount adjustment operation selection | 2, 4, 6, 9999 | 1 | 9999 | | |
| — | 674 | G061 | SF-PR slip amount adjustment gain | 0 to 500% | 0.1% | 100% | | |
| — | 684 | C000 | Tuning data unit switchover | 0, 1 | 1 | 0 | | |
| Maintenance | 686 | E712 | Maintenance timer 2 | 0 (1 to 9998) | 1 | 0 | | |
| | 687 | E713 | Maintenance timer 2 warning output set time | 0 to 9998, 9999 | 1 | 9999 | | |
| | 688 | E714 | Maintenance timer 3 | 0 (1 to 9998) | 1 | 0 | | |
| | 689 | E715 | Maintenance timer 3 warning output set time | 0 to 9998, 9999 | 1 | 9999 | | |
| Electronic thermal O/L relay | 692 | H011 | Second free thermal reduction frequency 1 | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | |
| | 693 | H012 | Second free thermal reduction ratio 1 | 1 to 100% | 1% | 100% | | |
| | 694 | H013 | Second free thermal reduction frequency 2 | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | |
| | 695 | H014 | Second free thermal reduction ratio 2 | 1 to 100% | 1% | 100% | | |
| | 696 | H015 | Second free thermal reduction frequency 3 | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | |
| — | 699 | T740 | Input terminal filter | 5 to 50 ms, 9999 | 1 ms | 9999 | | |

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|---|---|---|---|---|---|---|---|---|
| Motor constants | 702 | C106 | Maximum motor frequency | 0 to 400 Hz, 9999 | 0.01 Hz | 9999 | | |
| | 706 | C130 | Induced voltage constant (phi f) | 0 to 5000 mV/(rad/s), 9999 | 0.1 mV/(rad/s) | 9999 | | |
| | 707 | C107 | Motor inertia (integer) | 10 to 999, 9999 | 1 | 9999 | | |
| | 711 | C131 | Motor Ld decay ratio | 0 to 100%, 9999 | 0.1% | 9999 | | |
| | 712 | C132 | Motor Lq decay ratio | 0 to 100%, 9999 | 0.1% | 9999 | | |
| | 717 | C182 | Starting resistance tuning compensation | 0 to 200%, 9999 | 0.1% | 9999 | | |
| | 721 | C185 | Starting magnetic pole position detection pulse width | 0 to 6000 μs, 10000 to 16000 μs, 9999 | 1 μs | 9999 | | |
| | 724 | C108 | Motor inertia (exponent) | 0 to 7, 9999 | 1 | 9999 | | |
| | 725 | C133 | Motor protection current level | 100 to 500%, 9999 | 0.1% | 9999 | | |
| BACnet MS/TP protocol | 726 | N050 | Auto Baudrate/Max Master | 0 to 255 | 1 | 255 | | |
| | 727 | N051 | Max Info Frames | 1 to 255 | 1 | 1 | | |
| | 728 | N052 | Device instance number (Upper 3 digits) | 0 to 419 (0 to 418) | 1 | 0 | | |
| | 729 | N053 | Device instance number (Lower 4 digits) | 0 to 9999 (0 to 4302) | 1 | 0 | | |
| Motor constants | 738 | C230 | Second motor induced voltage constant (phi f) | 0 to 5000 mV/(rad/s), 9999 | 0.1 mV/(rad/s) | 9999 | | |
| | 739 | C231 | Second motor Ld decay ratio | 0 to 100%, 9999 | 0.1% | 9999 | | |
| | 740 | C232 | Second motor Lq decay ratio | 0 to 100%, 9999 | 0.1% | 9999 | | |
| | 741 | C282 | Second starting resistance tuning compensation | 0 to 200%, 9999 | 0.1% | 9999 | | |
| | 742 | C285 | Second motor magnetic pole detection pulse width | 0 to 6000 μs, 10000 to 16000 μs, 9999 | 1 μs | 9999 | | |
| | 743 | C206 | Second motor maximum frequency | 0 to 400 Hz, 9999 | 0.01 Hz | 9999 | | |
| | 744 | C207 | Second motor inertia (integer) | 10 to 999, 9999 | 1 | 9999 | | |
| | 745 | C208 | Second motor inertia (exponent) | 0 to 7, 9999 | 1 | 9999 | | |
| | 746 | C233 | Second motor protection current level | 100 to 500%, 9999 | 0.1% | 9999 | | |
| PID control | 753 | A650 | Second PID action selection | 0, 10, 11, 20, 21, 50, 51, 60, 61, 70, 71, 80, 81, 90, 91, 100, 101, 1000, 1001, 1010, 1011, 2000, 2001, 2010, 2011 | 1 | 0 | | |
| | 754 | A652 | Second PID control automatic switchover frequency | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | |
| | 755 | A651 | Second PID action set point | 0 to 100%, 9999 | 0.01% | 9999 | | |
| | 756 | A653 | Second PID proportional band | 0.1 to 1000%, 9999 | 0.1% | 100% | | |
| | 757 | A654 | Second PID integral time | 0.1 to 3600 s, 9999 | 0.1 s | 1 s | | |
| | 758 | A655 | Second PID differential time | 0.01 to 10 s, 9999 | 0.01 s | 9999 | | |
| | 759 | A600 | PID unit selection | 0 to 43, 9999 | 1 | 9999 | | |
| PID pre-charge function | 760 | A616 | Pre-charge fault selection | 0, 1 | 1 | 0 | | |
| | 761 | A617 | Pre-charge ending level | 0 to 100%, 9999 | 0.1% | 9999 | | |
| | 762 | A618 | Pre-charge ending time | 0 to 3600 s, 9999 | 0.1 s | 9999 | | |
| | 763 | A619 | Pre-charge upper detection level | 0 to 100%, 9999 | 0.1% | 9999 | | |
| | 764 | A620 | Pre-charge time limit | 0 to 3600 s, 9999 | 0.1 s | 9999 | | |
| | 765 | A656 | Second pre-charge fault selection | 0, 1 | 1 | 0 | | |
| | 766 | A657 | Second pre-charge ending level | 0 to 100%, 9999 | 0.1% | 9999 | | |
| | 767 | A658 | Second pre-charge ending time | 0 to 3600 s, 9999 | 0.1 s | 9999 | | |
| | 768 | A659 | Second pre-charge upper detection level | 0 to 100%, 9999 | 0.1% | 9999 | | |
| | 769 | A660 | Second pre-charge time limit | 0 to 3600 s, 9999 | 0.1 s | 9999 | | |
| Monitor function | 774 | M101 | Operation panel monitor selection 1 | 1 to 3, 5 to 14, 17, 18, 20, 23 to 25, 34, 38, 40 to 45, 50 to 57, 61, 62, 64, 67, 68, 81 to 96, 98, 100, 9999 | 1 | 9999 | | |
| | 775 | M102 | Operation panel monitor selection 2 | | 1 | 9999 | | |
| | 776 | M103 | Operation panel monitor selection 3 | | 1 | 9999 | | |
| — | 777 | A681 / T053 | 4 mA input fault operation frequency | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | |
| — | 778 | A682 / T054 | 4 mA input check filter | 0 to 10 s | 0.01 s | 0 s | | |
| — | 779 | N014 | Operation frequency during communication error | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | |
| — | 791 | F070 | Acceleration time in low-speed range | 0 to 3600 s, 9999 | 0.1 s | 9999 | | |
| — | 792 | F071 | Deceleration time in low-speed range | 0 to 3600 s, 9999 | 0.1 s | 9999 | | |
| — | 799 | M520 | Pulse increment setting for output power | 0.1, 1, 10, 100, 1000 kWh | 0.1 kWh | 1 kWh | | |

| Function | Pr. | Pr. group | Name | Setting range | Minimum setting increments | Initial value FM | Initial value CA | Customer setting |
|---|---|---|---|---|---|---|---|---|
| — | 800 | G200 | Control method selection | 9, 20 | 1 | 20 | | |
| Adjustment function | 820 | G211 | Speed control P gain 1 | 0 to 1000% | 1% | 25% | | |
| | 821 | G212 | Speed control integral time 1 | 0 to 20 s | 0.001 s | 0.333 s | | |
| | 822 | T003 | Speed setting filter 1 | 0 to 5 s, 9999 | 0.001 s | 9999 | | |
| | 824 | G213 | Torque control P gain 1 (current loop proportional gain) | 0 to 500% | 1% | 50% | | |
| | 825 | G214 | Torque control integral time 1 (current loop integral time) | 0 to 500 ms | 0.1 ms | 40 ms | | |
| | 827 | G216 | Torque detection filter 1 | 0 to 0.1 s | 0.001 s | 0 s | | |
| | 828 | G224 | Parameter for manufacturer setting. Do not set. | | | | | |
| | 830 | G311 | Speed control P gain 2 | 0 to 1000%, 9999 | 1% | 9999 | | |
| | 831 | G312 | Speed control integral time 2 | 0 to 20 s, 9999 | 0.001 s | 9999 | | |
| | 832 | T005 | Speed setting filter 2 | 0 to 5 s, 9999 | 0.001 s | 9999 | | |
| | 834 | G313 | Torque control P gain 2 | 0 to 500%, 9999 | 1% | 9999 | | |
| | 835 | G314 | Torque control integral time 2 | 0 to 500 ms, 9999 | 0.1 ms | 9999 | | |
| | 837 | G316 | Torque detection filter 2 | 0 to 0.1 s, 9999 | 0.001 s | 9999 | | |
| Additional function | 849 | T007 | Analog input offset adjustment | 0 to 200% | 0.1% | 100% | | |
| | 858 | T040 | Terminal 4 function assignment | 0, 4, 9999 | 1 | 0 | | |
| | 859 | C126 | Torque current/Rated PM motor current | 0 to 500 A, 9999 *2 / 0 to 3600 A, 9999 *3 | 0.01 A *2 / 0.1 A *3 | 9999 | | |
| | 860 | C226 | Second motor torque current/Rated PM motor current | 0 to 500 A, 9999 *2 / 0 to 3600 A, 9999 *3 | 0.01 A *2 / 0.1 A *3 | 9999 | | |
| | 864 | M470 | Torque detection | 0 to 400% | 0.1% | 150% | | |
| Indication function | 866 | M042 | Torque monitoring reference | 0 to 400% | 0.1% | 150% | | |
| — | 867 | M321 | AM output filter | 0 to 5 s | 0.01 s | 0.01 s | | |
| — | 868 | T010 | Terminal 1 function assignment | 0, 4, 9999 | 1 | 0 | | |
| — | 869 | M334 | Current output filter | 0 to 5 s | 0.01 s | — | 0.02 s | |
| — | 870 | M440 | Speed detection hysteresis | 0 to 5 Hz | 0.01 Hz | 0 Hz | | |
| Protective Functions | 872 *12 | H201 | Input phase loss protection selection | 0, 1 | 1 | 0 | | |
| | 874 | H730 | OLT level setting | 0 to 400% | 0.1% | 120% | 110% | |
| Regeneration avoidance function | 882 | G120 | Regeneration avoidance operation selection | 0 to 2 | 1 | 0 | | |
| | 883 | G121 | Regeneration avoidance operation level | 300 to 800 V | 0.1V | DC380 V *7 / DC760 V *8 | | |
| | 884 | G122 | Regeneration avoidance at deceleration detection sensitivity | 0 to 5 | 1 | 0 | | |
| | 885 | G123 | Regeneration avoidance compensation frequency limit value | 0 to 590 Hz, 9999 | 0.01 Hz | 6 Hz | | |
| | 886 | G124 | Regeneration avoidance voltage gain | 0 to 200% | 0.1% | 100% | | |
| Free parameters | 888 | E420 | Free parameter 1 | 0 to 9999 | 1 | 9999 | | |
| | 889 | E421 | Free parameter 2 | 0 to 9999 | 1 | 9999 | | |
| Energy saving monitor | 891 | M023 | Cumulative power monitor digit shifted times | 0 to 4, 9999 | 1 | 9999 | | |
| | 892 | M200 | Load factor | 30 to 150% | 0.1% | 100% | | |
| | 893 | M201 | Energy saving monitor reference (motor capacity) | 0.1 to 55 kW *2 / 0 to 3600 kW *3 | 0.01 kW *2 / 0.1 kW *3 | Rated inverter capacity | | |
| | 894 | M202 | Control selection during commercial power-supply operation | 0 to 3 | 1 | 0 | | |
| | 895 | M203 | Power saving rate reference value | 0, 1, 9999 | 1 | 9999 | | |
| | 896 | M204 | Power unit cost | 0 to 500, 9999 | 0.01 | 9999 | | |
| | 897 | M205 | Power saving monitor average time | 0 to 1000 h, 9999 | 1 h | 9999 | | |
| | 898 | M206 | Power saving cumulative monitor clear | 0, 1, 10, 9999 | 1 | 9999 | | |
| | 899 | M207 | Operation time rate (estimated value) | 0 to 100%, 9999 | 0.1% | 9999 | | |

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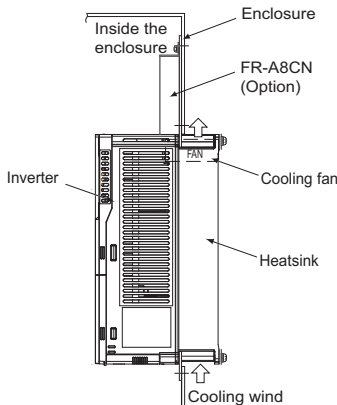LVS/Cables

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| Function | Pr. | Pr. group | Name | Setting range | Minimum setting increments | Initial value FM | Initial value CA | Customer setting |
|---|---|---|---|---|---|---|---|---|
| Calibration parameters | C0 (900) *9 | M310 | FM/CA terminal calibration | – | – | – | | |
| | C1 (901) *9 | M320 | AM terminal calibration | – | – | – | | |
| | C2 (902) *9 | T200 | Terminal 2 frequency setting bias frequency | 0 to 590 Hz | 0.01 Hz | 0 Hz | | |
| | C3 (902) *9 | T201 | Terminal 2 frequency setting bias | 0 to 300% | 0.1% | 0% | | |
| | 125 (903) *9 | T202 | Terminal 2 frequency setting gain frequency | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | |
| | C4 (903) *9 | T203 | Terminal 2 frequency setting gain | 0 to 300% | 0.1% | 100% | | |
| | C5 (904) *9 | T400 | Terminal 4 frequency setting bias frequency | 0 to 590 Hz | 0.01 Hz | 0 Hz | | |
| | C6 (904) *9 | T401 | Terminal 4 frequency setting bias | 0 to 300% | 0.1% | 20% | | |
| | 126 (905) *9 | T402 | Terminal 4 frequency setting gain frequency | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | |
| | C7 (905) *9 | T403 | Terminal 4 frequency setting gain | 0 to 300% | 0.1% | 100% | | |
| | C12 (917) *9 | T100 | Terminal 1 bias frequency (speed) | 0 to 590 Hz | 0.01 Hz | 0 Hz | | |
| | C13 (917) *9 | T101 | Terminal 1 bias (speed) | 0 to 300% | 0.1% | 0% | | |
| | C14 (918) *9 | T102 | Terminal 1 gain frequency (speed) | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | |
| | C15 (918) *9 | T103 | Terminal 1 gain (speed) | 0 to 300% | 0.1% | 100% | | |

| Function | Pr. | Pr. group | Name | Setting range | Minimum setting increments | Initial value FM | Initial value CA | Customer setting |
|---|---|---|---|---|---|---|---|---|
| Calibration parameters | C16 (919) *9 | T110 | Terminal 1 bias command (torque) | 0 to 400% | 0.1% | 0% | | |
| | C17 (919) *9 | T111 | Terminal 1 bias (torque) | 0 to 300% | 0.1% | 0% | | |
| | C18 (920) *9 | T112 | Terminal 1 gain command (torque) | 0 to 400% | 0.1% | 150% | | |
| | C19 (920) *9 | T113 | Terminal 1 gain (torque) | 0 to 300% | 0.1% | 100% | | |
| | C8 (930) *9 | M330 | Current output bias signal | 0 to 100% | 0.1% | — | | |
| | C9 (930) *9 | M331 | Current output bias current | 0 to 100% | 0.1% | — | 0% | |
| | C10 (931) *9 | M332 | Current output gain signal | 0 to 100% | 0.1% | — | 100% | |
| | C11 (931) *9 | M333 | Current output gain current | 0 to 100% | 0.1% | — | 100% | |
| | C38 (932) *9 | T410 | Terminal 4 bias command (torque) | 0 to 400% | 0.1% | 0% | | |
| | C39 (932) *9 | T411 | Terminal 4 bias (torque) | 0 to 300% | 0.1% | 20% | | |
| | C40 (933) *9 | T412 | Terminal 4 gain command (torque) | 0 to 400% | 0.1% | 150% | | |
| | C41 (933) *9 | T413 | Terminal 4 gain (torque) | 0 to 300% | 0.1% | 100% | | |
| | C42 (934) *9 | A630 | PID display bias coefficient | 0 to 500, 9999 | 0.01 | 9999 | | |
| | C43 (934) *9 | A631 | PID display bias analog value | 0 to 300% | 0.1% | 20% | | |
| | C44 (935) *9 | A632 | PID display gain coefficient | 0 to 500, 9999 | 0.01 | 9999 | | |
| | C45 (935) *9 | A633 | PID display gain analog value | 0 to 300% | 0.1% | 100% | | |
| — | 977 | E302 | Input voltage mode selection | 0, 1 | 1 | 0 | | |
| — | 989 | E490 | Parameter copy alarm release | 10 *2 / 100 *3 | 1 | 10 *2 / 100 *3 | | |
| PU | 990 | E104 | PU buzzer control | 0, 1 | 1 | 1 | | |
| | 991 | E105 | PU contrast adjustment | 0 to 63 | 1 | 58 | | |
| Monitor function | 992 | M104 | Operation panel setting dial push monitor selection | 0 to 3, 5 to 14, 17, 18, 20, 23 to 25, 34, 38, 40 to 45, 50 to 57, 61, 62, 64, 67, 68, 81 to 96, 98, 100 | 1 | 0 | | |
| — | 997 | H103 | Fault initiation | 0 to 255, 9999 | 1 | 9999 | | |
| — | 998 | E430 | PM parameter initialization (Simple) | 0, 12, 112, 8009, 8109, 9009, 9109 | 1 | 0 | | |
| — | 999 | E431 | Automatic parameter setting (Simple) | 1, 2, 10, 11, 12, 13, 20, 21, 9999 | 1 | 9999 | | |
| — | 1000 | E108 | Parameter for manufacturer setting. Do not set. | | | | | |
| — | 1002 | C150 | Lq tuning target current adjustment coefficient | 50 to 150%, 9999 | 0.1% | 9999 | | |
| Clock function | 1006 | E020 | Clock (year) | 2000 to 2099 | 1 | 2000 | | |
| | 1007 | E021 | Clock (month, day) | 1/1 to 12/31 | 1 | 101 | | |
| | 1008 | E022 | Clock (hour, minute) | 0:00 to 23:59 | 1 | 0 | | |

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| Function | Pr. | Pr. group | Name | Setting range | Minimum setting increments | Initial value FM | Initial value CA | Customer setting |
|---|---|---|---|---|---|---|---|---|
| – | 1013 *12 | H323 | Running speed after emergency drive retry reset | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | |
| – | 1015 | A607 | Integral stop selection at limited frequency | 0, 1, 10, 11 | 1 | 0 | | |
| – | 1016 | H021 | PTC thermistor protection detection time | 0 to 60 s | 1 s | 0 | | |
| Trace function | 1020 | A900 | Trace operation selection | 0 to 4 | 1 | 0 | | |
| | 1021 | A901 | Trace mode selection | 0 to 2 | 1 | 0 | | |
| | 1022 | A902 | Sampling cycle | 0 to 9 | 1 | 2 | | |
| | 1023 | A903 | Number of analog channels | 1 to 8 | 1 | 4 | | |
| | 1024 | A904 | Sampling auto start | 0, 1 | 1 | 0 | | |
| | 1025 | A905 | Trigger mode selection | 0 to 4 | 1 | 0 | | |
| | 1026 | A906 | Number of sampling before trigger | 0 to 100% | 1% | 90% | | |
| | 1027 | A910 | Analog source selection (1ch) | 1 to 3, 5 to 14, 17, 18, 20, 23, 24, 34, 40 to 42, 52 to 54, 61, 62, 64, 67, 68, 81 to 96, 98, 201 to 213, 230 to 232, 237, 238 | 1 | 201 | | |
| | 1028 | A911 | Analog source selection (2ch) | | | 202 | | |
| | 1029 | A912 | Analog source selection (3ch) | | | 203 | | |
| | 1030 | A913 | Analog source selection (4ch) | | | 204 | | |
| | 1031 | A914 | Analog source selection (5ch) | | | 205 | | |
| | 1032 | A915 | Analog source selection (6ch) | | | 206 | | |
| | 1033 | A916 | Analog source selection (7ch) | | | 207 | | |
| | 1034 | A917 | Analog source selection (8ch) | | | 208 | | |
| | 1035 | A918 | Analog trigger channel | 1 to 8 | 1 | 1 | | |
| | 1036 | A919 | Analog trigger operation selection | 0, 1 | 1 | 0 | | |
| | 1037 | A920 | Analog trigger level | 600 to 1400 | 1 | 1000 | | |
| | 1038 | A930 | Digital source selection (1ch) | 1 to 255 | 1 | 1 | | |
| | 1039 | A931 | Digital source selection (2ch) | | | 2 | | |
| | 1040 | A932 | Digital source selection (3ch) | | | 3 | | |
| | 1041 | A933 | Digital source selection (4ch) | | | 4 | | |
| | 1042 | A934 | Digital source selection (5ch) | | | 5 | | |
| | 1043 | A935 | Digital source selection (6ch) | | | 6 | | |
| | 1044 | A936 | Digital source selection (7ch) | | | 7 | | |
| | 1045 | A937 | Digital source selection (8ch) | | | 8 | | |
| | 1046 | A938 | Digital trigger channel | 1 to 8 | 1 | 1 | | |
| | 1047 | A939 | Digital trigger operation selection | 0, 1 | 1 | 0 | | |
| – | 1048 | E106 | Display-off waiting time | 0 to 60 min | 1 min | 0 | | |
| – | 1049 | E110 | USB host reset | 0, 1 | 1 | 0 | | |
| Monitor function | 1106 | M050 | Torque monitor filter | 0 to 5 s, 9999 | 0.01 s | 9999 | | |
| | 1107 | M051 | Running speed monitor filter | 0 to 5 s, 9999 | 0.01 s | 9999 | | |
| | 1108 | M052 | Excitation current monitor filter | 0 to 5 s, 9999 | 0.01 s | 9999 | | |

| Function | Pr. | Pr. group | Name | Setting range | Minimum setting increments | Initial value FM | Initial value CA | Customer setting |
|---|---|---|---|---|---|---|---|---|
| PID control | 1132 | A626 | Pre-charge change increment amount | 0 to 100%, 9999 | 0.01% | 9999 | | |
| | 1133 | A666 | Second pre-charge change increment amount | 0 to 100%, 9999 | 0.01% | 9999 | | |
| | 1134 | A605 | Parameter for manufacturer setting. Do not set. | | | | | |
| | 1135 | A606 | | | | | | |
| | 1136 | A670 | Second PID display bias coefficient | 0 to 500, 9999 | 0.01 | 9999 | | |
| | 1137 | A671 | Second PID display bias analog value | 0 to 300% | 0.1% | 20% | | |
| | 1138 | A672 | Second PID display gain coefficient | 0 to 500, 9999 | 0.01 | 9999 | | |
| | 1139 | A673 | Second PID display gain analog value | 0 to 300% | 0.1% | 100% | | |
| | 1140 | A664 | Second PID set point/deviation input selection | 1 to 5 | 1 | 2 | | |
| | 1141 | A665 | Second PID measured value input selection | 1 to 5, 101 to 105 | 1 | 3 | | |
| | 1142 | A640 | Second PID unit selection | 0 to 43, 9999 | 1 | 9999 | | |
| | 1143 | A641 | Second PID upper limit | 0 to 100%, 9999 | 0.1% | 9999 | | |
| | 1144 | A642 | Second PID lower limit | 0 to 100%, 9999 | 0.1% | 9999 | | |
| | 1145 | A643 | Second PID deviation limit | 0 to 100%, 9999 | 0.1% | 9999 | | |
| | 1146 | A644 | Second PID signal operation selection | 0 to 3, 10 to 13 | 1 | 0 | | |
| | 1147 | A661 | Second output interruption detection time | 0 to 3600 s, 9999 | 0.1 s | 1 | | |
| | 1148 | A662 | Second output interruption detection level | 0 to 590 Hz | 0.01 Hz | 0 Hz | | |
| | 1149 | A663 | Second output interruption cancel level | 900 to 1100% | 0.1% | 1000% | | |
| PLC function | 1150 to 1199 | A810 to A859 | PLC function user parameters 1 to 50 | 0 to 65535 | 1 | 0 | | |
| PID gain tuning | 1211 | A690 | PID gain tuning timeout time | 1 to 9999 s | 1 s | 100 s | | |
| | 1212 | A691 | Step manipulated amount | 900 to 1100% | 0.1% | 1000% | | |
| | 1213 | A692 | Step response sampling cycle | 0.01 to 600 s | 0.01 s | 1 s | | |
| | 1214 | A693 | Timeout time after the maximum slope | 1 to 9999 s | 1 s | 10 s | | |
| | 1215 | A694 | Limit cycle output upper limit | 900 to 1100% | 0.1% | 1100% | | |
| | 1216 | A695 | Limit cycle output lower limit | 900 to 1100% | 0.1% | 1000% | | |
| | 1217 | A696 | Limit cycle hysteresis | 0.1 to 10% | 0.1% | 1% | | |
| | 1218 | A697 | PID gain tuning setting | 0, 100 to 102, 111, 112, 121, 122, 200 to 202, 211, 212, 221, 222 | 1 | 0 | | |
| | 1219 | A698 | PID gain tuning start/status | (0), 1, 8, (9, 90 to 96) | 1 | 0 | | |
| — | 1300 to 1343, 1350 to 1359 | N500 to N543, N550 to N559 | Communication option parameters. For details, refer to the Instruction Manual of the option. | | | | | |
| PID gain tuning | 1460 | A683 | PID multistage set point 1 | 0 to 100%, 9999 | 0.01% | 9999 | | |
| | 1461 | A684 | PID multistage set point 2 | 0 to 100%, 9999 | 0.01% | 9999 | | |
| | 1462 | A685 | PID multistage set point 3 | 0 to 100%, 9999 | 0.01% | 9999 | | |
| | 1463 | A686 | PID multistage set point 4 | 0 to 100%, 9999 | 0.01% | 9999 | | |
| | 1464 | A687 | PID multistage set point 5 | 0 to 100%, 9999 | 0.01% | 9999 | | |
| | 1465 | A688 | PID multistage set point 6 | 0 to 100%, 9999 | 0.01% | 9999 | | |
| | 1466 | A689 | PID multistage set point 7 | 0 to 100%, 9999 | 0.01% | 9999 | | |

| Function | Pr. | Pr. group | Name | Setting range | Minimum setting increments | Initial value FM | Initial value CA | Customer setting |
|---|---|---|---|---|---|---|---|---|
| Cleaning | 1469 | A420 | Number of cleaning times monitor | 0 to 255 | 1 | 0 | | |
| | 1470 | A421 | Number of cleaning times setting | 0 to 255 | 1 | 0 | | |
| | 1471 | A422 | Cleaning trigger selection | 0 to 15 | 1 | 0 | | |
| | 1472 | A423 | Cleaning reverse rotation frequency | 0 to 590 Hz | 0.01 Hz | 30 Hz | | |
| | 1473 | A424 | Cleaning reverse rotation operation time | 0 to 3600 s | 0.1 s | 5 s | | |
| | 1474 | A425 | Cleaning forward rotation frequency | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | |
| | 1475 | A426 | Cleaning forward rotation operation time | 0 to 3600 s, 9999 | 0.1 s | 9999 | | |
| | 1476 | A427 | Cleaning stop time | 0 to 3600 s | 0.1 s | 5 s | | |
| | 1477 | A428 | Cleaning acceleration time | 0 to 3600 s, 9999 | 0.1 s | 9999 | | |
| | 1478 | A429 | Cleaning deceleration time | 0 to 3600 s, 9999 | 0.1 s | 9999 | | |
| | 1479 | A430 | Cleaning time trigger | 0 to 6000 h | 0.1 h | 0 h | | |
| Load characteristics fault detection | 1480 | H520 | Load characteristics measurement mode | 0, 1 (2 to 5, 81 to 85) | 1 | 0 | | |
| | 1481 | H521 | Load characteristics load reference 1 | 0 to 400%, 8888, 9999 | 0.1% | 9999 | | |
| | 1482 | H522 | Load characteristics load reference 2 | 0 to 400%, 8888, 9999 | 0.1% | 9999 | | |
| | 1483 | H523 | Load characteristics load reference 3 | 0 to 400%, 8888, 9999 | 0.1% | 9999 | | |
| | 1484 | H524 | Load characteristics load reference 4 | 0 to 400%, 8888, 9999 | 0.1% | 9999 | | |
| | 1485 | H525 | Load characteristics load reference 5 | 0 to 400%, 8888, 9999 | 0.1% | 9999 | | |
| | 1486 | H526 | Load characteristics maximum frequency | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | |
| | 1487 | H527 | Load characteristics minimum frequency | 0 to 590 Hz | 0.01 Hz | 6 Hz | | |
| | 1488 | H530 | Upper limit warning detection width | 0 to 400%, 9999 | 0.1% | 20% | | |
| | 1489 | H531 | Lower limit warning detection width | 0 to 400%, 9999 | 0.1% | 20% | | |
| | 1490 | H532 | Upper limit fault detection width | 0 to 400%, 9999 | 0.1% | 9999 | | |
| | 1491 | H533 | Lower limit fault detection width | 0 to 400%, 9999 | 0.1% | 9999 | | |
| | 1492 | H534 | Load status detection signal delay time / load reference measurement waiting time | 0 to 60 s | 0.1 s | 1 s | | |
| Clear parameters | | Pr.CLR | Parameter clear | (0), 1 | 1 | 0 | | |
| | | ALL.CL | All parameter clear | (0), 1 | 1 | 0 | | |
| | | Err.CL | Fault history clear | (0), 1 | 1 | 0 | | |
| — | | Pr.CPY | Parameter copy | (0), 1 to 3 | 1 | 0 | | |
| — | | Pr.CHG | Initial value change list | — | 1 | 0 | | |
| — | | IPM | IPM initialization | 0, 12 | 1 | 0 | | |
| — | | AUTO | Automatic parameter setting | — | — | — | | |
| — | | Pr.MD | Group parameter setting | (0), 1, 2 | 1 | 0 | | |

∗1 Differ according to capacities.
6%: FR-F820-00046(0.75K), FR-F840-00023(0.75K)
4%: FR-F820-00077(1.5K) to FR-F820-00167(3.7K), FR-F840-00038(1.5K) to FR-F840-00083(3.7K)
3%: FR-F820-00250(5.5K), FR-F820-00340(7.5K), FR-F840-00126(5.5K), FR-F840-00170(7.5K)
2%: FR-F820-00490(11K) to FR-F820-01540(37K), FR-F840-00250(11K) to FR-F840-00770(37K)
1.5%: FR-F820-01870(45K), FR-F820-02330(55K), FR-F840-00930(45K), FR-F840-01160(55K)
1%: FR-F820-03160(75K) or higher, FR-F840-01800(75K) or higher
∗2 The setting range or initial value for the FR-F820-02330(55K) or lower and FR-F840-01160(55K) or lower.
∗3 The setting range or initial value for the FR-F820-03160(75K) or higher and FR-F840-01800(75K) or higher.
∗4 The initial value for the FR-F820-00340(7.5K) or lower and FR-F840-00170(7.5K) or lower.
∗5 The initial value for the FR-F820-00490(11K) or higher and FR-F840-00250(11K) or higher.
∗6 Differ according to capacities.
4%: FR-F820-00340(7.5K) or lower, FR-F840-00170(7.5K) or lower
2%: FR-F820-00490(11K) to FR-F820-02330(55K), FR-F840-00250(11K) to FR-F840-01160(55K)
1%: FR-F820-03160(75K) or higher, FR-F840-01800(75K) or higher
∗7 The value for the 200 V class.
∗8 The value for the 400 V class.
∗9 The parameter number in parentheses is the one for use with the LCD operation panel and the parameter unit.
∗10 The setting range or initial value for the standard model.
∗11 The setting range or initial value for the separated converter type.
∗12 The setting is available for the standard model only.
∗13 The setting is available only with the 400 V class.

# Converter unit parameter list (by parameter number)

Set the necessary parameters to meet the load and operational specifications. Parameter setting, change and check can be performed from the operation panel (FR-DU08).

| Function | Pr. | Pr. group | Name | Setting range | Minimum setting increments | Initial value | Customer setting |
|---|---|---|---|---|---|---|---|
| — | 30 | E300 | Reset selection during power supply to main circuit | 0, 100 | 1 | 0 | |
| Automatic restart | 57 | A702 | Restart selection | 0, 9999 | 1 | 9999 | |
| — | 65 | H300 | Retry selection | 0 to 4 | 1 | 0 | |
| Retry | 67 | H301 | Number of retries at fault occurrence | 0 to 10, 101 to 110 | 1 | 0 | |
| | 68 | H302 | Retry waiting time | 0.1 to 600 s | 0.1 s | 1 s | |
| | 69 | H303 | Retry count display erase | 0 | 1 | 0 | |
| — | 75 | — | Reset selection/disconnected PU detection/reset limit | 14 to 17, 114 to 117 | 1 | 14 | |
| | | E100 | Reset selection | 0, 1 | | 0 | |
| | | E101 | Disconnected PU detection | | | | |
| | | E107 | Reset limit | | | | |
| — | 77 | E400 | Parameter write selection | 1, 2 | 1 | 2 | |
| PU connector communication | 117 | N020 | PU communication station number | 0 to 31 | 1 | 0 | |
| | 118 | N021 | PU communication speed | 48, 96, 192, 384, 576, 768, 1152 | 1 | 192 | |
| | 119 | — | PU communication stop bit length / data length | 0, 10 | 1 | 1 | |
| | | N022 | PU communication data length | 0, 1 | | 0 | |
| | | N023 | PU communication stop bit length | 0, 1 | | 1 | |
| | 120 | N024 | PU communication parity check | 0 to 2 | 1 | 2 | |
| | 121 | N025 | Number of PU communication retries | 0 to 10, 9999 | 1 | 1 | |
| | 122 | N026 | PU communication check time interval | 0, 0.1 to 999.8 s, 9999 | 0.1 s | 9999 | |
| | 123 | N027 | PU communication waiting time setting | 0 to 150 ms, 9999 | 1 ms | 9999 | |
| | 124 | N028 | PU communication CR/LF selection | 0 to 2 | 1 | 1 | |
| — | 161 | E200 | Key lock operation selection | 0, 10 | 1 | 0 | |
| — | 168 | E000 | Parameter for manufacturer setting. | | | | |
| | | E080 | | | | | |
| — | 169 | E001 | | | | | |
| | | E081 | | | | | |
| Cumulative monitor clear | 170 | M020 | Watt-hour meter clear | 0, 10, 9999 | 1 | 9999 | |
| Input terminal function assignment | 178 | T700 | RDI terminal function selection | 7, 62, 9999 | 1 | 9999 | |
| | 187 | T709 | OH terminal function selection | | 1 | 7 | |
| | 189 | T711 | RES terminal function selection | | 1 | 62 | |
| Output terminal function assignment | 190 | M400 | RDB terminal function selection | 2, 8, 11, 17, 25, 26, 64, 68, 90, 94, 95, 98, 99, 102, 108, 111, 125, 126, 164, 168, 190, 194, 195, 198, 199, 206, 207, 209, 210, 214, 306, 307, 309, 310, 9999 | 1 | 111 | |
| | 191 | M401 | RDA terminal function selection | | 1 | 11 | |
| | 192 | M402 | IPF terminal function selection | | 1 | 2 | |
| | 193 | M403 | RSO terminal function selection | | 1 | 209 | |
| | 194 | M404 | FAN terminal function selection | | 1 | 25 | |
| | 195 | M405 | ABC1 terminal function selection | | 1 | 99 | |
| — | 248 | A006 | Self power management selection | 0 to 2 | 1 | 0 | |

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| Function | Pr. | Pr. group | Name | Setting range | Minimum setting increments | Initial value | Customer setting |
|---|---|---|---|---|---|---|---|
| Life check | 255 | E700 | Life alarm status display | (0 to 15) | 1 | 0 | |
| | 256 | E701 | Inrush current limit circuit life display | (0 to 100%) | 1% | 100% | |
| | 257 | E702 | Control circuit capacitor life display | (0 to 100%) | 1% | 100% | |
| — | 261 | A730 | Power failure stop selection | 0, 1, 2, 21, 22 | 1 | 0 | |
| — | 268 | M022 | Monitor decimal digits selection | 0, 1, 9999 | 1 | 9999 | |
| — | 269 | E023 | Parameter for manufacturer setting. Do not set. | | | | |
| — | 290 | M044 | Monitor negative output selection | 0, 2, 4, 6 | 1 | 0 | |
| Password function | 296 | E410 | Password lock level | 0 to 3, 5, 6, 100 to 103, 105, 106, 9999 | 1 | 9999 | |
| | 297 | E411 | Password lock/unlock | (0 to 5), 1000 to 9998, 9999 | 1 | 9999 | |
| RS-485 communication | 331 | N030 | RS-485 communication station number | 0, 31 (0, 247) | 1 | 0 | |
| | 332 | N031 | RS-485 communication speed | 3, 6, 12, 24, 48, 96, 192, 384, 576, 768, 1152 | 1 | 96 | |
| | 333 | — | RS-485 communication stop bit length / data length | 0, 1, 10, 11 | 1 | 1 | |
| | | N032 | RS-485 communication data length | 0, 1 | 1 | 0 | |
| | | N033 | RS-485 communication stop bit length | 0, 1 | 1 | 1 | |
| | 334 | N034 | RS-485 communication parity check selection | 0 to 2 | 1 | 2 | |
| | 335 | N035 | RS-485 communication retry count | 0 to 10, 9999 | 1 | 1 | |
| | 336 | N036 | RS-485 communication check time interval | 0 to 999.8 s, 9999 | 0.1 s | 0 s | |
| | 337 | N037 | RS-485 communication waiting time setting | 0 to 150 ms, 9999 | 1 ms | 9999 | |
| | 341 | N038 | RS-485 communication CR/LF selection | 0 to 2 | 1 | 1 | |
| | 342 | N001 | Communication EEPROM write selection | 0, 1 | 1 | 0 | |
| | 343 | N080 | Communication error count | — | 1 | 0 | |
| Maintenance | 503 | E710 | Maintenance timer 1 | 0 (1 to 9998) | 1 | 0 | |
| | 504 | E711 | Maintenance timer 1 warning output set time | 0 to 9998, 9999 | 1 | 9999 | |
| — | 539 | N002 | Modbus-RTU communication check time interval | 0 to 999.8 s, 9999 | 0.1 s | 9999 | |
| Communication | 549 | N000 | Protocol selection | 0, 1 | 1 | 0 | |
| — | 563 | M021 | Energization time carrying-over times | (0 to 65535) | 1 | 0 | |
| — | 598 | H102 | Undervoltage level | 350 to 430 V, 9999 | 0.1 V | 9999 | |
| — | 663 | M060 | Control circuit temperature signal output level | 0 to 100°C | 1°C | 0°C | |
| Maintenance | 686 | E712 | Maintenance timer 2 | 0 (1 to 9998) | 1 | 0 | |
| | 687 | E713 | Maintenance timer 2 warning output set time | 0 to 9998, 9999 | 1 | 9999 | |
| | 688 | E714 | Maintenance timer 3 | 0 (1 to 9998) | 1 | 0 | |
| | 689 | E715 | Maintenance timer 3 warning output set time | 0 to 9998, 9999 | 1 | 9999 | |
| Monitor function | 774 | M101 | Operation panel monitor selection 1 | 2, 8, 13, 20, 25, 43, 44, 55, 62, 98, 9999 | 1 | 9999 | |
| | 775 | M102 | Operation panel monitor selection 2 | | 1 | 9999 | |
| | 776 | M103 | Operation panel monitor selection 3 | | 1 | 9999 | |
| Protective Functions | 872 | H201 | Input phase loss protection selection | 0, 1 | 1 | 0 | |

| Function | Pr. | Pr. group | Name | Setting range | Minimum setting increments | Initial value | Customer setting |
|---|---|---|---|---|---|---|---|
| — | 876 | T723 | OH input selection | 0 to 2 | 1 | 0 | |
| Free parameters | 888 | E420 | Free parameter 1 | 0 to 9999 | 1 | 9999 | |
| Free parameters | 889 | E421 | Free parameter 2 | 0 to 9999 | 1 | 9999 | |
| Energy saving monitor | 891 | M023 | Cumulative power monitor digit shifted times | 0 to 4, 9999 | 1 | 9999 | |
| PU | 990 | E104 | PU buzzer control | 0, 1 | 1 | 1 | |
| Monitor function | 992 | M104 | Operation panel setting dial push monitor selection | 2, 8, 13, 20, 25, 43, 44, 55, 62, 98 | 1 | 8 | |
| — | 997 | H103 | Fault initiation | 0 to 255, 9999 | 1 | 9999 | |
| Clock function | 1006 | E020 | Clock (year) | 2000 to 2099 | 1 | 2000 | |
| Clock function | 1007 | E021 | Clock (month, day) | 1/1 to 12/31 | 1 | 101 | |
| Clock function | 1008 | E022 | Clock (hour, minute) | 0:00 to 23:59 | 1 | 0 | |
| — | 1048 | E106 | Display-off waiting time | 0 to 60 min | 1 min | 0 | |
| Clear parameters | | Pr.CLR | Parameter clear | (0), 1 | 1 | 0 | |
| Clear parameters | | ALL.CL | All parameter clear | (0), 1 | 1 | 0 | |
| Clear parameters | | Err.CL | Fault history clear | (0), 1 | 1 | 0 | |
| — | | Pr.CPY | Parameter copy | (0), 1 to 3 | 1 | 0 | |
| — | | Pr.CHG | Initial value change list | — | 1 | 0 | |
| — | | Pr.MD | Group parameter setting | (0), 1, 2 | 1 | 0 | |

# ✳ Protective Functions

## ● The list of inverter protective functions

When the inverter detects a fault, depending on the nature of the fault, the operation panel displays an error message or warning, or a protective function activates to trip the inverter.

| | Name | Description | Operation panel indication |
|---|---|---|---|
| **Error message \*2** | Faults history | The operation panel stores the fault indications which appears when a protective function is activated to display the fault record for the past eight faults. | E ---- |
| | Operation panel lock | Appears when operation was tried during operation panel lock. | HOLd |
| | Password locked | Appears when a password restricted parameter is read/written. | LOCd |
| | Parameter write error | Appears when an error occurred during parameter writing. | Er 1 to Er 4 Er 8 |
| | Copy operation error | Appears when an error occurred during parameter copying. | rE 1 to rE4 rE6 to rE8 |
| | Error | Appears when the RES signal is on or the PU and inverter can not make normal communication. | Err. |
| **Warning \*3** | Stall prevention (overcurrent) | Appears during overcurrent stall prevention. | OL |
| | Stall prevention (overvoltage) | Appears during overvoltage stall prevention. Appears while the regeneration avoidance function is activated. | oL |
| | Electronic thermal relay function pre-alarm | Appears when the electronic thermal O/L relay has reached 85% of the specified value. | rH |
| | PU stop | Appears if [STOP RESET] is pressed in an operation mode other than the PU operation mode. | PS |
| | Parameter copy | Appears when parameter copy is performed between inverters FR-F820-02330(55K) or lower, FR-F840-01160(55K) or lower, FR-F820-03160(75K) or higher and FR-F840-01800(75K) or higher | CP |
| | Safety stop | Appears when safety stop function is activated (during output shutoff). | SA |
| | Maintenance signal output 1 to 3 \*7 | Appears when the inverter's cumulative energization time reaches or exceeds the parameter set value. | MF 1 to MF 3 |
| | USB host error | Appears when an excessive current flows into the USB A connector. | UF |
| | 24 V external power supply operation | Flickers when the main circuit power supply is off and the 24 V external power supply is being input. | EV |
| | Load fault warning \*7 | Appears when the present load status deviates from the upper and lower limit warning detection width. | LdF |
| | Emergency drive in operation | Appears during emergency drive operation. (Standard models only) | Ed |
| **Alarm \*4** | Fan alarm | Appears when the cooling fan remains stopped when operation is required or when the speed has decreased. | FN |
| **Fault \*5** | Overcurrent trip during acceleration | Appears when an overcurrent occurred during acceleration. | E. OC 1 |
| | Overcurrent trip during constant speed | Appears when an overcurrent occurred during constant speed operation. | E. OC2 |
| | Overcurrent trip during deceleration or stop | Appears when an overcurrent occurred during deceleration and at a stop. | E. OC3 |
| | Regenerative overvoltage trip during acceleration | Appears when an overvoltage occurred during acceleration. | E. OV 1 |
| | Regenerative overvoltage trip during constant speed | Appears when an overvoltage occurred during constant speed operation. | E. OV2 |
| | Regenerative overvoltage trip during deceleration or stop | Appears when an overvoltage occurred during deceleration and at a stop. | E. OV 3 |
| | Inverter overload trip (electronic thermal relay function) \*1 | Appears when the electronic thermal relay function for inverter element protection was activated. | E. rHr |
| | Motor overload trip (electronic thermal relay function) \*1 | Appears when the electronic thermal relay function for motor protection was activated. | E. rHM |
| | Heatsink overheat | Appears when the heatsink overheated. | E. FIN |
| | Instantaneous power failure | Appears when an instantaneous power failure occurred at an input power supply. (Standard models only) | E. IPF |
| | Undervoltage | Appears when the main circuit DC voltage became low. (Standard models only) | E. UVr |
| | Input phase loss \*7 | Appears if one of the three phases on the inverter input side opened. (Standard models only) | E. ILF |
| | Stall prevention stop | Appears 3 s after the output frequency is reduced to the reference value by the stall prevention (torque limit) operation. | E. OLr |
| | Loss of synchronism detection | The inverter trips when the motor operation is not synchronized. (This function is only available under PM sensorless vector control.) | E. SOr |
| | Upper limit fault detection \*7 | Appears when the present load status exceeds the upper limit warning detection width. | E. LUP |
| | Lower limit fault detection \*7 | Appears when the present load status falls below the lower limit warning detection width. | E. LdN |
| | Output side earth (ground) fault overcurrent | Appears when an earth (ground) fault occurred on the Inverter's output side. | E. GF |
| | Output phase loss | Appears if one of the three phases on the inverter output side opened. | E. LF |
| | External thermal relay operation \*6 | Appears when the external thermal relay connected to the terminal OH is activated. | E. OHr |

| Name | Description | Operation panel indication |
|---|---|---|
| **Fault** [5] **PTC thermistor operation** | The inverter trips if resistance of the PTC thermistor connected between the terminal 2 and terminal 10 has reached the **Pr.561 PTC thermistor protection level** setting or higher. | E. PTC |
| **Option fault** | Appears when torque command by the plug-in option is selected using **Pr. 804** when no plug-in option is mounted or an AC power supply is connected to the R/L1, S/L2, T/L3 when the high power factor converter and power regeneration common converter connection setting (**Pr.30** =2) is selected. | E. OPT |
| **Communication option fault** | Appears when a communication line error occurs in the communication option. | E. OP 1 |
| **Parameter storage device fault** | Appears when operation of the element where parameters stored became abnormal. (control board) | E. PE |
| **PU disconnection** | Appears when a communication error between the PU and inverter occurred, the communication interval exceeded the permissible time during the RS-485 communication with the PU connecter, or communication errors exceeded the number of retries during the RS-485 communication. | E. PUE |
| **Retry count excess** [7] | Appears when the operation was not restarted within the set number of retries. | E. RET |
| **Parameter storage device fault** | Appears when operation of the element where parameters stored became abnormal. (main circuit board) | E. PE2 |
| **CPU fault** | Appears during the CPU and peripheral circuit errors occurred. | E. CPU<br>E. 5 to<br>E. 7 |
| **Operation panel power supply short circuit/RS-485 terminals power supply short circuit** | Appears when the RS-485 terminal power supply or operation panel power supply was shorted. | E. CTE |
| **24 VDC power fault** | When the 24 VDC power output via the terminal PC is shorted, or when the external 24 VDC power supplied to the terminal +24 is not enough, this function shuts off the power output. | E. P24 |
| **Abnormal output current detection** [7] | Appears when the output current is out of the output current detection range set by parameters. | E. CdO |
| **Inrush current limit circuit fault** | Appears when the resistor of the inrush current limit circuit overheated. (Standard models only) | E. IOH |
| **Communication fault (inverter)** | Appears when a communication error occurred during the RS-485 communication with the RS-485 terminals. | E. SER |
| **Analog input fault** | Appears when 30 mA or more is input or a voltage (7.5 V or more) is input with the terminal 2/4 set to current input. | E. AIE |
| **USB communication fault** | Appears when USB communication error occurred. | E. USb |
| **Safety circuit fault** | The inverter trips when a safety circuit fault occurs. | E. SAF |
| **Overspeed occurrence** [7] | Indicates that the motor speed has exceeded the overspeed setting level **(Pr.374)**. | E. OS |
| **4 mA input fault** [7] | The inverter trips when the analog input current is 2 mA or less for the time set in **Pr.778 4 mA input check filter**. | E. LCI |
| **Pre-charge fault** [7] | The inverter trips when the pre-charge time exceeds **Pr.764 Pre-charge time limit**.<br>The inverter trips when the measured value exceeds **Pr.763 Pre-charge upper detection level** during pre-charging. | E. PCH |
| **PID signal fault** [7] | The inverter trips if the measured value exceeds the PID upper limit or PID lower limit parameter setting, or the absolute deviation value exceeds the PID deviation parameter setting during PID control. | E. PId |
| **Option fault** | The inverter trips when a contact fault is found between the inverter and the plug-in option, or when the communication option is not connected to the connector 1. | E. 1 to<br>E. 3 |
| **Internal circuit fault** | Appears when an internal circuit error occurred. | E. bE<br>E. PbT<br>E. 13 |
| **User definition error by the PLC function** | Appears when the values 16 to 20 are set in the device SD1214 with the program operation of the PLC function. | E. 16 to<br>E. 20 |

*1 Resetting the inverter initializes the internal cumulative heat value of the electronic thermal O/L relay function.
*2 The error message shows an operational error. The inverter output is not shut off.
*3 Warnings are messages given before faults occur. The inverter output is not shut off.
*4 Alarm warn the operator of failures with output signals. The inverter output is not shut off.
*5 When faults occur, the protective functions are activated to shut off the inverter output and output the alarms.
*6 The external thermal operates only when the OH signal is set in **Pr.178 to Pr.189 (input terminal function selection)**.
*7 This protective function is not available in the initial status.

Features | Application Example PLC Function FR Configurator2 | Connection Examples | Standard Specs | Outline Dimensions | Terminal Connection Diagrams Terminal Specs | Operation Panel | Operation Steps | Parameter List | Protective Functions | Options | LVS/Cables | Precautions | Motors | Compatibility | Warranty Inquiry

## ● The list of converter unit protective functions

When the converter unit detects a fault, depending on the nature of the fault, the operation panel displays an error message or warning, or a protective function activates to trip the inverter.

| | Name | Description | Operation panel indication |
|---|---|---|---|
| **Error message** *2 | Faults history | The operation panel stores the fault indications which appears when a protective function is activated to display the fault record for the past eight faults. | E -- -- -- -- |
| | Operation panel lock | Appears when operation was tried during operation panel lock. | HOLd |
| | Password locked | Appears when a password restricted parameter is read/written. | LOCd |
| | Parameter write error | Appears when an error occurred during parameter writing. | Er 1 |
| | Copy operation error | Appears when an error occurred during parameter copying. | rE 1 to rE4 |
| | Error | Appears when the RES signal is on or the PU and converter unit can not make normal communication. | Err. |
| **Warning** *3 | Electronic thermal relay function pre-alarm | Appears when the electronic thermal O/L relay has reached 85% of the specified value. | rH |
| | Maintenance signal output 1 to 3 *7 | Appears when the converter unit's cumulative energization time reaches or exceeds the parameter set value. | Mr 1 to Mr 3 |
| | 24 V external power supply operation | Flickers when the main circuit power supply is off and the 24 V external power supply is being input. | EV |
| **Alarm** *4 | Fan alarm | Appears when the cooling fan remains stopped when operation is required or when the speed has decreased. | FN |
| **Fault** *5 | Overvoltage trip | Appears when the converter unit's internal main circuit DC voltage exceeds the specified value. | E. OVr |
| | Converter overload trip (electronic thermal relay function) *1 | Appears when the electronic thermal O/L relay of the converter unit diode module is activated. | E. rHC |
| | Heatsink overheat | Appears when the heatsink overheated. | E. FIN |
| | Instantaneous power failure | Appears when an instantaneous power failure occurred at an input power supply. | E. IPF |
| | Undervoltage | Appears when power supply voltage of the converter unit is set at a low level. | E. UVr |
| | Input phase loss *7 | Appears if one of the three phases on the converter unit input side opened. | E. ILF |
| | External thermal relay operation *6 | Appears when the external thermal relay connected to the terminal OH is activated. | E. OHr |
| | Parameter storage device fault | Appears when operation of the element where parameters stored became abnormal. (control board) | E. PE |
| | PU disconnection | Appears when a communication error between the PU and inverter occurred, the communication interval exceeded the permissible time during the RS-485 communication with the PU connecter, or communication errors exceeded the number of retries during the RS-485 communication. | E. PUE |
| | Retry count excess *7 | Appears when the operation was not restarted within the set number of retries. | E. REr |
| | Parameter storage device fault | Appears when operation of the element where parameters stored became abnormal. (main circuit board) | E. PE2 |
| | CPU fault | Appears during the CPU and peripheral circuit errors occurred. | E. CPU E. 5 to E. 7 |
| | Operation panel power supply short circuit/RS-485 terminals power supply short circuit | Appears when the RS-485 terminal power supply or operation panel power supply was shorted. | E. CrE |
| | 24 VDC power fault | When the 24 VDC power output via the terminal PC is shorted, or when the external 24 VDC power supplied to the terminal +24 is not enough, this function shuts off the power output. | E. P24 |
| | Inrush current limit circuit fault | Appears when the resistor of the inrush current limit circuit overheated. | E. IOH |
| | Communication fault (inverter) | Appears when a communication error occurred during the RS-485 communication with the RS-485 terminals. | E. SER |
| | Internal circuit fault | Appears when an internal circuit error occurred. | E. Pbr E. 13 |
| | Option fault | The inverter trips if a plug-in option is disconnected while the converter unit power is ON. | E. 1 |

*1 Resetting the converter unit initializes the internal cumulative heat value of the electronic thermal O/L relay function.
*2 The error message shows an operational error. The inverter output is not shut off.
*3 Warnings are messages given before faults occur. The inverter output is not shut off.
*4 Alarm warn the operator of failures with output signals. The inverter output is not shut off.
*5 When faults occur, the protective functions are activated to shut off the inverter output and output the alarms.
*6 The external thermal operates only when the OH signal is set in **Pr.178, Pr.180, Pr.187 or Pr.189 (input terminal function selection)**.
*7 This protective function is not available in the initial status.

# Option and Peripheral Devices

## ● Option List

By fitting the following options to the inverter, the inverter is provided with more functions.
Three plug-in options can be fitted at a time. (more than two same options and communication options can not be fitted)

| Name | | | Type | Applications, Specifications, etc. | Applicable Inverter |
|---|---|---|---|---|---|
| **Plug-in Type** | **16-bit digital input** | | FR-A8AX | This input interface sets the high frequency accuracy of the inverter using an external BCD or binary digital signal.<br> BCD code 3 digits (maximum 999)<br> BCD code 4 digits (maximum 9999)<br> Binary 12 bits (maximum FFFH)<br> Binary 16 bits (maximum FFFFH) | Shared among all models |
| | **Digital output Extension analog output** | | FR-A8AY | Output signals provided with the inverter as standard are selected to output from the open collector. | |
| | | | | This option adds 2 different signals that can be monitored at the terminals AM0 and AM1, such as the output frequency, output voltage and output current.<br>20mADC or 10VDC meter can be connected. | |
| | **Relay output** | | FR-A8AR | Output any three output signals available with the inverter as standard from the relay contact terminals. | |
| | **Communication** | CC-Link communication | FR-A8NC | This option allows the inverter to be operated or monitored or the parameter setting to be changed from a computer or programmable controller. | |
| | | CC-Link/IE field network communication | FR-A8NCE | | |
| | | DeviceNet communication | FR-A8ND | | |
| | | PROFIBUS-DP communication | FR-A8NP | | |
| **Stand-alone Shared** | **Liquid crystal display operation panel** | | FR-LU08 | Graphical operation panel with liquid crystal display ∗2 | Shared among all models |
| | **Parameter unit** | | FR-PU07 | Interactive parameter unit with LCD display | |
| | **Parameter unit with battery pack** | | FR-PU07BB(-L) | Enables parameter setting without supplying power to the inverter. | |
| | **Parameter unit connection cable** | | FR-CB20□ | Cable for connection of operation panel or parameter unit<br>□ indicates a cable length. (1m, 3m, 5m) | |
| | **Operation panel connection connector** | | FR-ADP | Connector to connect the operation panel (FR-DU08) and connection cable. | |
| | **Control circuit terminal block intercompatibility attachment** | | FR-A8TAT | An attachment for installing the control circuit terminal block of the FR-F700(P)/F500 series to that of the FR-F800 series | Shared among all models |
| | **Heatsink protrusion attachment** | | FR-A8CN | The inverter heatsink section can be protruded outside of the rear of the enclosure. For the enclosure cut dimensions, refer to **page 30**. | FR-F820-00105(2.2K) to FR-F820-04750(110K), FR-F840-00023(0.75K) to FR-F840-03610(160K) According to capacities |
| | **Intercompatibility attachment** | | FR-AAT | Attachment for replacing with the FR-F800 series using the installation holes of the FR-F700(P)/F500/A100E series. | According to capacities |
| | | | FR-A5AT | | |
| | | | FR-F8AT | | |
| | **AC reactor** | | FR-HAL | For harmonic current reduction and inverter input power factor improvement | According to capacities |
| | **DC reactor** | | FR-HEL | | |
| | **Line noise filter** | | FR-BSF01 | For line noise reduction | Shared among all models |
| | | | FR- BLF | | |
| **Stand-alone Shared** | **Brake unit** | | FR-BU2 | For increasing the braking capability of the inverter (for high-inertia load or negative load)<br>Brake unit and resistor unit are used in combination | According to capacities |
| | **Resistor unit** | | FR-BR | | FR-F820-02330(55K) or lower, FR-F840-01160(55K) or lower |
| | | | MT-BR5 | | FR-F820-03160(75K) or higher, FR-F840-01800(75K) or higher |
| | **Power regeneration common converter Stand-alone reactor dedicated for the FR-CV** | | FR-CV FR-CVL | Unit which can return motor-generated braking energy back to the power supply in common converter system | FR-F820-02330(55K) or lower, FR-F840-01160(55K) or lower |
| | **Power regeneration converter** | | MT- RC | Energy saving type high performance brake unit which can regenerate the braking energy generated by the motor to the power supply. | FR-F840-01800(75K) or higher |
| | **High power factor converter** | | FR-HC2 | The high power factor converter switches the converter section on/off to reshape an input current waveform into a sine wave, greatly suppressing harmonics. (Used in combination with the standard accessory.) | According to capacities |
| | **Surge voltage suppression filter** | | FR-ASF | Filter for suppressing surge voltage on motor | FR-F840-01160(55K) or lower |
| | | | FR-BMF | | FR-F840-00126(5.5K) to FR-F840-00770(37K) According to capacities |
| | **Sine wave filter** | Reactor | MT- BSL (-HC) | Reduce the motor noise during inverter driving<br>Use in combination with a reactor and a capacitor | FR-F820-03160(75K) or higher, FR-F840-01800(75K) or higher According to capacities |
| | | Capacitor | MT- BSC | | |

| | Name | Type | Applications, Specifications, etc. | Applicable Inverter |
|---|---|---|---|---|
| **FR Series Manual Controller/Speed Controller** | Manual controller | FR-AX | For independent operation. With frequency meter, frequency potentiometer and start switch. | Shared among all models |
| | DC tach. follower | FR-AL | For synchronous operation (1VA) by external signal (0 to 5V, 0 to 10V DC) *1 | |
| | Three speed selector | FR-AT | For three speed switching, among high, middle and low speed operation (1.5VA) *1 | |
| | Motorized speed setter | FR-FK | For remote operation. Allows operation to be controlled from several places (5VA) *1 | |
| | Ratio setter | FR-FH | For ratio operation. Allows ratios to be set to five inverters. (3VA) *1 | |
| | Speed detector | FR-FP | For tracking operation by a pilot generator (PG) signal (2VA) *1 | |
| | Master controller | FR-FG | Master controller (5VA) for parallel operation of multiple (maximum 35) inverters. *1 | |
| | Soft starter | FR-FC | For soft start and stop. Enables acceleration/deceleration in parallel operation (3VA) *1 | |
| | Deviation detector | FR-FD | For continuous speed control operation. Used in combination with a deviation sensor or synchro (5VA) *1 | |
| | Preamplifier | FR-FA | Used as an A/V converter or arithmetic amplifier (3VA) *1 | |
| **Others** | Pilot generator | QVAH-10 | For tracking operation. 70V/35VAC 500Hz (at 2500r/min) | |
| | Deviation sensor | YVGC-500W-NS | For continuous speed control operation (mechanical deviation detection) Output 90VAC/90° | |
| | Frequency setting potentiometer | WA2W 1kΩ | For frequency setting. Wire-wound 2W 1kΩ type B characteristic | |
| | Analog frequency meter (64mm × 60mm) | YM206NRI 1mA | Dedicated frequency meter (graduated to 120Hz). Moving-coil type DC ammeter | |
| | Calibration resistor | RV24YN 10kΩ | For frequency meter calibration. Carbon film type B characteristic | |
| | Inverter setup software (FR Configurator2) | SW1DND-FRC2-E | Supports an inverter startup to maintenance. | |

*1 Rated power consumption. The power supply specifications of the FR series manual controllers and speed controllers are 200VAC 50Hz, 200V/220VAC 60Hz, and 115VAC 60Hz.
*2 The battery (CR1216: a diameter of 12 mm, a hight of 16 mm) is not bundled.

## ● Stand-alone option

| Name (model) | Specification and Structure |
|---|---|
| **Heatsink protrusion attachment FR-A8CN[]** | With this attachment the heatsink which is the exothermic section of the inverter can be placed on the rear of the enclosure. Since the heat generated in the inverter can be radiated to the rear of the enclosure, the enclosure can be downsized.<br>The use of this attachment requires more installation area. For installation, refer to the drawing after attachment installation (**page 30**).<br>For the enclosure cut dimensions, refer to **page 30**.<br>• Applicable model |

| Model | Applicable inverter | |
|---|---|---|
| | **FR-F820** | **FR-F840** |
| **FR-A8CN01** | 00105(2.2K), 00167(3.7K), 00250(5.5K) | 00023(0.75K), 00038(1.5K), 00052(2.2K), 00083(3.7K), 00126(5.5K) |
| **FR-A8CN02** | 00340(7.5K), 00490(11K) | 00170(7.5K), 00250(11K) |
| **FR-A8CN03** | 00630(15K) | 00310(15K), 00380(18.5K) |
| **FR-A8CN04** | 00770(18.5K), 00930(22K), 01250(30K) | 00470(22K), 00620(30K) |
| **FR-A8CN05** | 01540(37K) | 00770(37K) |
| **FR-A8CN06** | 01870(45K), 02330(55K) | 00930(45K), 01160(55K), 01800(75K) |
| **FR-A8CN07** | 03160(75K) | — |
| **FR-A8CN08** | 03800(90K), 04750(110K) | 03250(132K), 03610(160K) |
| **FR-A8CN09** | — | 02160(90K), 02600(110K) |

Inside the enclosure

Enclosure

FR-A8CN (Option)

FAN

Inverter

Cooling fan

Heatsink

Cooling wind

Features

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| Name (model) | Specification and Structure |
|---|---|
| **Intercompatibility attachment FR-AAT[] FR-A5AT[] FR-F8AT[]** | (see below) |

Enables FR-F800 to be attached using the mounting holes made for the conventional FR-F700(P)/F500/A100E series inverter.
This attachment is useful when replacing a conventional inverter with FR-F800.

[FR-AAT, FR-A5AT]
The inverter with this attachment requires greater installation depth.

• Models replaceable with FR-F820

| | | | FR-F820 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 0.75K/1.5K | 2.2K to 5.5K | 7.5K/11K | 15K | 18.5K to 30K | 37K | 45K/55K |
| Conventional model and capacity | FR-A120E | 0.75K | FR-A5AT01 | — | — | — | — | — | — |
| | | 1.5K to 3.7K | FR-A5AT02 | FR-A5AT02 | — | — | — | — | — |
| | | 5.5K to 11K | — | FR-A5AT03 | FR-A5AT03 | — | — | — | — |
| | | 15K/18.5K | — | — | FR-AAT02 | FR-AAT24 | ○ | — | — |
| | | 22K/30K | — | — | — | FR-A5AT04 | FR-A5AT04 | — | — |
| | | 37K | — | — | — | — | FR-AAT27 | ○ | — |
| | | 45K | — | — | — | — | — | FR-AAT23 | ○ |
| | | 55K | — | — | — | — | — | — | FR-A5AT05 |
| | FR-F520 | 0.75K | ○ | — | — | — | — | — | — |
| | | 1.5K to 3.7K | FR-AAT21 | ○ | — | — | — | — | — |
| | | 5.5K/7.5K | — | FR-AAT22 | ○ | — | — | — | — |
| | | 11K | — | FR-A5AT03 | FR-A5AT03 | — | — | — | — |
| | | 15K to 22K | — | — | FR-AAT02 | FR-AAT24 | ○ | — | — |
| | | 30K | — | — | — | FR-A5AT04 | FR-A5AT04 | — | — |
| | | 37K | — | — | — | — | FR-AAT27 | ○ | — |
| | | 45K | — | — | — | — | — | FR-AAT23 | ○ |
| | | 55K | — | — | — | — | — | — | FR-A5AT05 |
| | FR-F720(P) | 0.75K/1.5K | ○ | — | — | — | — | — | — |
| | | 2.2K to 5.5K | FR-AAT21 | ○ | — | — | — | — | — |
| | | 7.5K/11K | — | FR-AAT22 | ○ | — | — | — | — |
| | | 15K | — | FR-A5AT03 | FR-A5AT03 | ○ | — | — | — |
| | | 18.5K to 30K | — | — | — | FR-AAT24 | ○ | — | — |
| | | 37K | — | — | — | — | FR-AAT27 | ○ | — |
| | | 45K/55K | — | — | — | — | — | FR-AAT23 | ○ |

• Models replaceable with FR-F840

| | | | FR-F840 | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 0.75K to 5.5K | 7.5K/11K | 15K/18.5K | 22K/30K | 37K | 45K/55K |
| Conventional model and capacity | FR-A140E | 0.75K to 3.7K | FR-A5AT02 | — | — | — | — | — |
| | | 5.5K to 11K | FR-A5AT03 | FR-A5AT03 | — | — | — | — |
| | | 15K/18.5K | — | FR-AAT02 | FR-AAT24 | — | — | — |
| | | 22K | — | — | FR-A5AT04 | FR-A5AT04 | — | — |
| | | 30K | — | — | — | FR-AAT27 | — | — |
| | | 37K/45K | — | — | — | — | FR-AAT23 | ○ |
| | | 55K | — | — | — | — | — | FR-A5AT05 |
| | FR-F540 | 0.75K to 3.7K | ○ | — | — | — | — | — |
| | | 5.5K to 11K | FR-AAT22 | ○ | — | — | — | — |
| | | 15K to 22K | — | FR-AAT02 | FR-AAT24 | ○ | — | — |
| | | 30K/37K | — | — | — | FR-AAT27 | ○ | — |
| | | 45K/55K | — | — | — | — | FR-AAT23 | ○ |
| | FR-F740(P) | 0.75K to 5.5K | ○ | — | — | — | — | — |
| | | 7.5K/11K | — | ○ | — | — | — | — |
| | | 15K/18.5K | FR-A5AT03 | FR-A5AT03 | ○ | — | — | — |
| | | 22K/30K | — | — | FR-AAT24 | ○ | — | — |
| | | 37K | — | — | — | FR-AAT27 | ○ | — |
| | | 45K/55K | — | — | — | — | FR-AAT23 | ○ |

○: Replaceable without the intercompatibility attachment
FR-A5AT[][], FR-AAT[][]: Replaceable with the intercompatibility attachment.

[FR-F8AT]
The FR-F8AT01 can be used in replacing FR-F520L-75K and FR-F720-75K with FR-F820-03160(75K).

| Name (model) | Specification and Structure |
|---|---|

**Control circuit terminal block intercompatibility attachment FR-A8TAT**

This attachment allows the conventional FR-F700(P)/F500 series control circuit terminal blocks to be installed without removing any cables. This attachment is useful when replacing a conventional inverter with FR-F700P.

FR-A8TAT

FR-F700(P)/F500 series control circuit terminal block
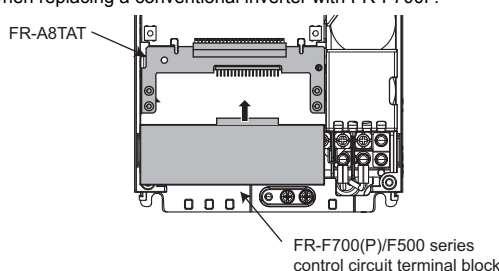
(a)   For using the control circuit terminal block of the FR-F500 series, open or remove the cover of the control circuit terminal block. Otherwise, the front cover of the inverter may not close properly.
(b)   Since the specifications of the control circuit terminals of the FR-F700(P)/F500 series are different from those of the FR-F800 series, certain functions of the inverter are restricted (refer to the table below).

|  | Relay output 2 terminals | 24 V external power supply input terminal | Safety stop signal terminals |
|---|---|---|---|
| **FR-F500 series** | × | × | × |
| **FR-F700(P) series** | ○ | × | × |

○...Available, ×...Not available

(c)   The FR-A8NC or FR-A8NCE plug-in option cannot be used.
(d)   When using a plug-in option, connect the plug-in option using a cable that can be routed through the space between the front cover and the control circuit terminal block (FR-F700(P) series: 7 mm, FR-F500 series: 0.8 mm).

**AC reactor (for power supply coordination) FR-HAL-(H)☐K**

Improves the power factor and reduces the harmonic current at the input side. Connect an AC reactor at the input side of the inverter.
• Selection method
  Select an AC reactor according to the applied motor capacity. (Select the AC reactor according to the motor capacity even if the capacity is smaller than the inverter capacity.)
• Connection diagram

FR-HAL        Inverter

Three-phase AC power supply    R — X — R/L1    U — Motor M
                               S — Y — S/L2    V
                               T — Z — T/L3    W

• Outline dimensions (Unit: mm)

**200V**
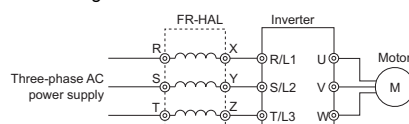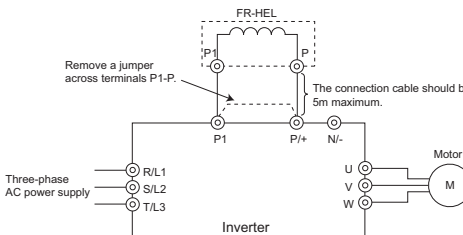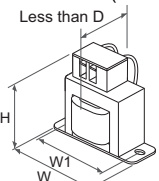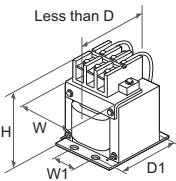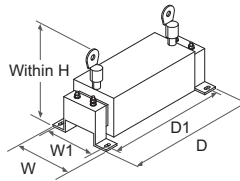
| Model | W | W1 | H | D | D1 | d | Mass (kg) |
|---|---|---|---|---|---|---|---|
| 0.4K | 104 | 84 | 99 | 72 | 40 | M5 | 0.6 |
| 0.75K | 104 | 84 | 99 | 74 | 44 | M5 | 0.8 |
| 1.5K | 104 | 84 | 99 | 77 | 50 | M5 | 1.1 |
| 2.2K | 115 | 40 | 115 | 77 | 57 | M6 | 1.5 |
| 3.7K | 115 | 40 | 115 | 83 | 67 | M6 | 2.2 |
| 5.5K | 115 | 40 | 115 | 83 | 67 | M6 | 2.3 |
| 7.5K | 130 | 50 | 135 | 100 | 86 | M6 | 4.2 |
| 11K | 160 | 75 | 164 | 111 | 92 | M6 | 5.2 |
| 15K | 160 | 75 | 167 | 126 | 107 | M6 | 7.0 |
| 18.5K | 160 | 75 | 128 | 175 | 107 | M6 | 7.1 |
| 22K | 185 | 75 | 150 | 158 | 87 | M6 | 9.0 |
| 30K | 185 | 75 | 150 | 168 | 87 | M6 | 9.7 |
| 37K | 210 | 75 | 175 | 174 | 82 | M6 | 12.9 |
| 45K | 210 | 75 | 175 | 191 | 97 | M6 | 16.4 |
| 55K | 210 | 75 | 175 | 201 | 97 | M6 | 17.4 |
| 75K | 240 | 150 | 210 | 215.5 | 109 | M8 | 23 |
| 110K | 330 | 170 | 325 | 259 | 127 | M10 | 40 |

**400V**

| Model | W | W1 | H | D | D1 | d | Mass (kg) |
|---|---|---|---|---|---|---|---|
| H0.4K | 135 | 120 | 115 | 64 | 45 | M4 | 1.5 |
| H0.75K | 135 | 120 | 115 | 64 | 45 | M4 | 1.5 |
| H1.5K | 135 | 120 | 115 | 64 | 45 | M4 | 1.5 |
| H2.2K | 135 | 120 | 115 | 64 | 45 | M4 | 1.5 |
| H3.7K | 135 | 120 | 115 | 74 | 57 | M4 | 2.5 |
| H5.5K | 160 | 145 | 142 | 76 | 55 | M4 | 3.5 |
| H7.5K | 160 | 145 | 142 | 96 | 75 | M4 | 5.0 |
| H11K | 160 | 145 | 146 | 96 | 75 | M4 | 6.0 |
| H15K | 220 | 200 | 195 | 105 | 70 | M5 | 9.0 |
| H18.5K | 220 | 200 | 215 | 170 | 70 | M5 | 9.0 |
| H22K | 220 | 200 | 215 | 170 | 70 | M5 | 9.5 |
| H30K | 220 | 200 | 215 | 170 | 75 | M5 | 11 |
| H37K | 220 | 200 | 214 | 170 | 100 | M5 | 12.5 |
| H45K | 280 | 255 | 245 | 165 | 80 | M6 | 15 |
| H55K | 280 | 255 | 245 | 170 | 90 | M6 | 18 |
| H75K | 210 | 75 | 170 | 210.5 | 105 | M6 | 20 |
| H110K | 240 | 150 | 225 | 220 | 99 | M8 | 28 |
| H185K | 330 | 170 | 325 | 271 | 142 | M10 | 55 |
| H280K | 330 | 170 | 325 | 321 | 192 | M10 | 80 |
| H355K | 330 | 170 | 325 | 346 | 192 | M10 | 90 |
| H560K | 450 | 300 | 540 | 635 | 345 | M12 | 190 |
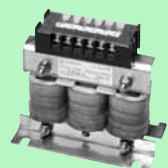
(a)   Approximately 88% of the power factor improving effect can be obtained (92.3% when calculated with 1 power factor for the fundamental wave according to the Architectural Standard Specifications (Electrical Installation) (2013 revision) supervised by the Ministry of Land, Infrastructure, Transport and Tourism of Japan).
(b)   This is a sample outline dimension drawing. The shape differs by the model. W1 and D1 indicate distances between installation holes. The installation hole size is indicated by d.
(c)   When installing an AC reactor (FR-HAL), install in the orientation shown below.
  •(H)55K or lower: Horizontal installation or vertical installation
  •(H)75K or higher: Horizontal installation
(d)   Keep enough clearance around the reactor because it heats up.
  (Keep a clearance of minimum 10cm each on top and bottom and minimum 5cm each on right and left regardless of the installation orientation.)

Less than D
H
D1    W1
W

| Name (model) | Specification and Structure |
|---|---|
| **DC reactor (for power supply coordination) FR-HEL-(H)[]K** | |

Improves the power factor and reduces the harmonic current at the input side.
Make sure to install this option for the FR-F820-03160(75K) or higher and the FR-F840-01800(75K) or higher.
• Selection method
  Select a DC reactor according to the applied motor capacity. (Select it according to the motor capacity even if the capacity is smaller than the inverter capacity.) (Refer to **page 106**.)
• Connection diagram
  Connect a DC reactor to the inverter terminals P1 and P. For the FR-F820-02330(55K) or lower and FR-F840-01160(55K) or lower, the jumper across terminals P1 and P must be removed. (If the jumper is left attached, no power factor improvement can be obtained.)
  The connection cable between the reactor and the inverter should be as short as possible (5m or less).

• Outline dimension (Unit: mm)

FR-HEL-0.4K to 2.2K
FR-HEL-H0.4K

FR-HEL-3.7K to 55K
FR-HEL-H0.75K to H55K

FR-HEL-75K to 110K
FR-HEL-H75K to H355K

**200V**

| Model | W | W1 | W1 | D | D1 | d | Mass (kg) |
|---|---|---|---|---|---|---|---|
| 0.4K | 70 | 60 | 71 | 61 | - | M4 | 0.4 |
| 0.75K | 85 | 74 | 81 | 61 | - | M4 | 0.5 |
| 1.5K | 85 | 74 | 81 | 70 | - | M4 | 0.8 |
| 2.2K | 85 | 74 | 81 | 70 | - | M4 | 0.9 |
| 3.7K | 77 | 55 | 92 | 82 | 57 | M4 | 1.5 |
| 5.5K | 77 | 55 | 92 | 92 | 67 | M4 | 1.9 |
| 7.5K | 86 | 60 | 113 | 98 | 72 | M4 | 2.5 |
| 11K | 105 | 64 | 133 | 112 | 79 | M6 | 3.3 |
| 15K | 105 | 64 | 133 | 115 | 84 | M6 | 4.1 |
| 18.5K | 105 | 64 | 93 | 165 | 94 | M6 | 4.7 |
| 22K | 105 | 64 | 93 | 175 | 104 | M6 | 5.6 |
| 30K | 114 | 72 | 100 | 200 | 101 | M6 | 7.8 |
| 37K | 133 | 86 | 117 | 195 | 98 | M6 | 10 |
| 45K | 133 | 86 | 117 | 205 | 108 | M6 | 11 |
| 55K | 153 | 126 | 132 | 209 | 122 | M6 | 12.6 |
| 75K | 150 | 130 | 190 | 340 | 310 | M6 | 17 |
| 90K | 150 | 130 | 200 | 340 | 310 | M6 | 19 |
| 110K | 175 | 150 | 200 | 400 | 365 | M8 | 20 |

**400V**

| Model | W | W1 | W1 | D | D1 | d | Mass (kg) |
|---|---|---|---|---|---|---|---|
| H0.4K | 90 | 75 | 78 | 60 | - | M5 | 0.6 |
| H0.75K | 66 | 50 | 100 | 70 | 48 | M4 | 0.8 |
| H1.5K | 66 | 50 | 100 | 80 | 54 | M4 | 1 |
| H2.2K | 76 | 50 | 110 | 80 | 54 | M4 | 1.3 |
| H3.7K | 86 | 55 | 120 | 95 | 69 | M4 | 2.3 |
| H5.5K | 96 | 60 | 128 | 100 | 75 | M5 | 3 |
| H7.5K | 96 | 60 | 128 | 105 | 80 | M5 | 3.5 |
| H11K | 105 | 75 | 137 | 110 | 85 | M5 | 4.5 |
| H15K | 105 | 75 | 152 | 125 | 95 | M5 | 5 |
| H18.5K | 114 | 75 | 162 | 120 | 80 | M5 | 5 |
| H22K | 133 | 90 | 178 | 120 | 75 | M5 | 6 |
| H30K | 133 | 90 | 178 | 120 | 80 | M5 | 6.5 |
| H37K | 133 | 90 | 187 | 155 | 100 | M5 | 8.5 |
| H45K | 133 | 90 | 187 | 170 | 110 | M5 | 10 |
| H55K | 152 | 105 | 206 | 170 | 106 | M6 | 11.5 |
| H75K | 140 | 120 | 185 | 320 | 295 | M6 | 16 |
| H90K | 150 | 130 | 190 | 340 | 310 | M6 | 20 |
| H110K | 150 | 130 | 195 | 340 | 310 | M6 | 22 |
| H132K | 175 | 150 | 200 | 405 | 370 | M8 | 26 |
| H160K | 175 | 150 | 205 | 405 | 370 | M8 | 28 |
| H185K | 175 | 150 | 240 | 405 | 370 | M8 | 29 |
| H220K | 175 | 150 | 240 | 405 | 370 | M8 | 30 |
| H250K | 190 | 165 | 250 | 440 | 400 | M8 | 35 |
| H280K | 190 | 165 | 255 | 440 | 400 | M8 | 38 |
| H315K | 210 | 185 | 250 | 495 | 450 | M10 | 42 |
| H355K | 210 | 185 | 250 | 495 | 450 | M10 | 46 |

(a) The size of the cables used should be equal to or larger than that of the power supply cables (R/L1, S/L2, T/L3). (Refer to **page 98**)
(b) Approximately 93% of the power factor improving effect can be obtained (94.4% when calculated with 1 power factor for the fundamental wave according to the Architectural Standard Specifications (Electrical Installation) (2013 revision) supervised by the Ministry of Land, Infrastructure, Transport and Tourism of Japan).
(c) The drawings shown above are sample outline dimension drawings. The shape differs by the model. W1 and D1 indicate distances between installation holes. The installation hole size is indicated by d.
(d) When installing a DC reactor (FR-HEL), install in the orientation shown below.
  •(H)55K or lower: Horizontal installation or vertical installation
  •(H)75K or higher: Horizontal installation
(e) Keep enough clearance around the reactor because it heats up.
  (Keep a clearance of minimum 10cm each on top and bottom and minimum 5cm each on right and left regardless of the installation orientation.)

| Name (model) | Specification and Structure |
|---|---|
| **Line noise filter FR-BSF01 (for small capacities) FR-BLF** | Install an EMC filter (ferrite core) to reduce the electromagnetic noise generated from the inverter. Effective in the range from about 0.5 MHz to 5 MHz. range from about 0.5MHz to 5MHz. The FR-F820-02330(55K) or lower and FR-F840-01160(55K) or lower are equipped with built-in common mode chokes.<br>• Outline dimension<br><br>FR-BSF01     FR-BLF<br>110, 95, 2-φ5, 22.5, 65, 33, 4.5, 65<br>31.5, φ7, 130, 85, 80, 35, 2.3, 160, 180, 7<br>(Unit: mm)<br><br>(a) Wind each phase for three times (4T) in the same direction. (The greater the number of turns, the more effective result is obtained.)<br>When using several line noise filters to make 4T or more, wind the phases (cables) together. Do not use a different line noise filter for different phases.<br>(b) When the cables are too thick to be winded, run each cable (phase) through four or more filters installed in series in one direction.<br>(c) The filter can be used in the same way as the output side. When using filters at the output side, do not wind the cable more than 3 times (4T) for each filter because the filter may overheat.<br>(d) A thick cable of 38 mm$^2$ or more is not applicable to the FR-BSF01. Use FR-BLF for a larger diameter cable.<br>(e) Do not wind the earthing (grounding) cable.<br><br>MCCB   Inverter<br>Power supply   R/L1 S/L2 T/L3<br>Line noise filter |

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| Name (model) | Specification and Structure |
|---|---|

Provides a braking capability greater than that is provided by an external brake resistor. This option can also be connected to the inverters without built-in brake transistors. Three types of discharging resistors are available. Make a selection according to the required braking torque.
• Specification
[Brake unit]

| Model FR-BU2-[] | 200V | | | | | | 400V | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1.5K | 3.7K | 7.5K | 15K | 30K | 55K | H7.5K | H15K | H30K | H55K | H75K | H220K | H280K |
| Applicable motor capacity | The applicable capacity differs by the braking torque and the operation rate (%ED). | | | | | | | | | | | | |
| Connected brake resistor | GRZG type, FR-BR, MT-BR5 (For the combination, refer to the table below.) | | | | | | | | | | | MT-BR5∗1 | |
| Multiple (parallel) driving | Max. 10 units (However, the torque is limited by the permissible current of the connected inverter.) | | | | | | | | | | | | |
| Approximate mass (kg) | 0.9 | 0.9 | 0.9 | 0.9 | 1.4 | 2.0 | 0.9 | 0.9 | 1.4 | 2.0 | 2.0 | 13 | 13 |

∗1　Please contact your sales representative to use a brake resistor other than MT-BR5.
[Resistor unit]

| Model GRZG type | 200V | | | | 400V | | |
|---|---|---|---|---|---|---|---|
| | GZG300W-50Ω | GRZG200-10Ω | GRZG300-5Ω | GRZG400-2Ω | GRZG200-10Ω | GRZG300-5Ω | GRZG400-2Ω |
| Number of connectable units | 1 unit | 3 in series | 4 in series | 6 in series | 6 in series | 8 in series | 12 in series |
| Discharging resistor combined resistance (Ω) | 50 | 30 | 20 | 12 | 60 | 40 | 24 |
| Continuous operation permissible power (W) | 100 | 300 | 600 | 1200 | 600 | 1200 | 2400 |

| Model FR-BR-[] | 200V | | | 400V | | |
|---|---|---|---|---|---|---|
| | 15K | 30K | 55K | H15K | H30K | H55K |
| Discharging resistor combined resistance (Ω) | 8 | 4 | 2 | 32 | 16 | 8 |
| Continuous operation permissible power (W) | 990 | 1990 | 3910 | 990 | 1990 | 3910 |
| Approximate mass (kg) | 15 | 30 | 70 | 15 | 30 | 70 |

| Model FR-BR-[] | 200V | 400V |
|---|---|---|
| | 55K | H75K |
| Discharging resistor combined resistance (Ω) | 2 | 6.5 |
| Continuous operation permissible power (W) | 5500 | 7500 |
| Approximate mass (kg) | 70 | 65 |

**Brake unit FR-BU2-(H)[]K**

**Resistor unit FR-BR-(H)[]K MT-BR5-(H)[]K**

**Discharging resistor GZG type GRZG type**



• Combination between the brake unit and the resistor unit

| Brake unit model | | Discharging resistor model or resistor unit model | | |
|---|---|---|---|---|
| | | GRZG type | FR-BR | MT-BR5 |
| 200V | FR-BU2-1.5K | GZG 300W-50Ω (1 unit) | - | - |
| | FR-BU2-3.7K | GRZG 200-10Ω (3 in parallel) | - | - |
| | FR-BU2-7.5K | GRZG 300-5Ω (4 in parallel) | - | - |
| | FR-BU2-15K | GRZG 400-2Ω (6 in parallel) | FR-BR-15K | - |
| | FR-BU2-30K | - | FR-BR-30K | - |
| | FR-BU2-55K | - | FR-BR-55K | MT-BR5-55K |
| 400V | FR-BU2-H7.5K | GRZG 200-10Ω (6 in parallel) | - | - |
| | FR-BU2-H15K | GRZG 300-5Ω (8 in parallel) | FR-BR-H15K | - |
| | FR-BU2-H30K | GRZG 400-2Ω (12 in parallel) | FR-BR-H30K | - |
| | FR-BU2-H55K | - | FR-BR-H55K | - |
| | FR-BU2-H75K | - | - | MT-BR5-H75K |
| | FR-BU2-H220K | - | - | 3×MT-BR5-H75K ∗2 |
| | FR-BU2-H280K | - | - | 4×MT-BR5-H75K ∗2 |

∗2　The number next to the model name indicates the number of connectable units in parallel.
• Selection method
[GRZG type]
• The maximum temperature rise of the discharging resistors is about 100°C. Use heat-resistant wires to perform wiring, and make sure that they will not come in contact with resistors.
• Do not touch the discharging resistor while the power is ON or for about 10 minutes after the power supply turns OFF. Otherwise you may get an electric shock.

| Power supply voltage | Braking torque | Motor capacity | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 |
| 200V | 50% 30s | FR-BU2-1.5K | | | FR-BU2-3.7K | | FR-BU2-7.5K | | FR-BU2-15K | |
| | 100% 30s | FR-BU2-1.5K | | FR-BU2-3.7K | FR-BU2-7.5K | | FR-BU2-15K | | 2×FR-BU2-15K ∗3 | |
| 400V | 50% 30s | -∗4 | | | FR-BU2-H7.5K | | | FR-BU2-H15K | | |
| | 100% 30s | -∗4 | | | FR-BU2-H7.5K | | FR-BU2-H15K | | FR-BU2-H30K | |

| Power supply voltage | Braking torque | Motor capacity | | | | | |
|---|---|---|---|---|---|---|---|
| | | 18.5 | 22 | 30 | 37 | 45 | 55 |
| 200V | 50% 30s | 2×FR-BU2-15K∗3 | | | 3×FR-BU2-15K∗3 | | 4×FR-BU2-15K∗3 |
| | 100% 30s | 3×FR-BU2-15K∗3 | | 4×FR-BU2-15K∗3 | 5×FR-BU2-15K∗3 | 6×FR-BU2-15K∗3 | 7×FR-BU2-15K∗3 |
| 400V | 50% 30s | FR-BU2-H30K | | | 2×FR-BU2-H30K ∗3 | | |
| | 100% 30s | 2×FR-BU2-H30K∗3 | | | 3×FR-BU2-H30K ∗3 | | 4×FR-BU2-H30K∗3 |

∗3　The number next to the model name indicates the number of connectable units in parallel.
∗4　FR-F840-00038(1.5K) or lower capacity inverters cannot be used with brake units. When using brake units with inverters, use the FR-F840-00052(2.2K) or higher capacity inverters.

| Name (model) | Specification and Structure |
|---|---|

**[FR-BR]**
The maximum temperature rise of the resistor unit is about 100°C. Therefore, use heat-resistant wires (such as glass wires).

%ED at short-time rating when braking torque is 100%

| Model | | | Motor capacity | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 5.5kW | 7.5kW | 11kW | 15kW | 18.5kW | 22kW | 30kW | 37kW | 45kW | 55kW |
| 200V | FR-BU2-15K | %ED | 80 | 40 | 15 | 10 | - | - | - | - | - | - |
| | FR-BU2-30K | | - | - | 65 | 30 | 25 | 15 | 10 | - | - | - |
| | FR-BU2-55K | | - | - | - | - | 90 | 60 | 30 | 20 | 15 | 10 |
| 400V | FR-BU2-H15K | %ED | 80 | 40 | 15 | 10 | - | - | - | - | - | - |
| | FR-BU2-H30K | | - | - | 65 | 30 | 25 | 15 | 10 | - | - | - |
| | FR-BU2-H55K | | - | - | - | - | 90 | 60 | 30 | 20 | 15 | 10 |

Braking torque (%) at 10%ED in short-time rating of 15s(%)

| Model | | | Motor capacity | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 5.5kW | 7.5kW | 11kW | 15kW | 18.5kW | 22kW | 30kW | 37kW | 45kW | 55kW |
| 200V | FR-BU2-15K | Braking torque (%) | 280 | 200 | 120 | 100 | 80 | 70 | - | - | - | - |
| | FR-BU2-30K | | - | - | 260 | 180 | 160 | 130 | 100 | 80 | 70 | - |
| | FR-BU2-55K | | - | - | - | - | 300 | 250 | 180 | 150 | 120 | 100 |
| 400V | FR-BU2-H15K | Braking torque (%) | 280 | 200 | 120 | 100 | 80 | 70 | - | - | - | - |
| | FR-BU2-H30K | | - | - | 260 | 180 | 160 | 130 | 100 | 80 | 70 | - |
| | FR-BU2-H55K | | - | - | - | - | 300 | 250 | 180 | 150 | 120 | 100 |

$$\text{Regeneration duty factor (operation frequency)}\%ED = \frac{tb}{tc} \times 100 \qquad tb < 15s \text{ (continuous operation time)}$$

Example 1  Travel operation — Speed / Time t (tb, tc)
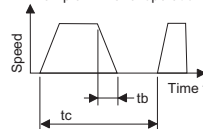
Example 2  Lift operation — Speed / Ascending / Descending / Time t (t1, t2, t3, t4, tc, tb=t1+t2+t3+t4)
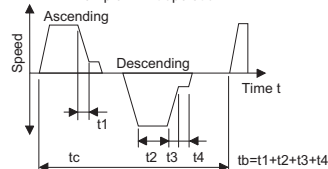
**[MT-BR5]**
- Be sure to select a well-ventilated place for the installation of the resistor unit. Ventilation is necessary when installing the resistor in a place such as an enclosure, where heat is not well diffused.
- The maximum temperature rise of the resistor unit is about 300deg. When wiring, be careful not to touch the resistor. Also, keep any heat-sensitive component away from the resistor (minimum 40 to 50cm).
- The temperature of the resistor unit abnormally increases if the brake unit is operated exceeding the specified duty. Since the resistor unit may result in overheat if the temperature of the brake unit is left unchanged, switch off the inverter.
- A resistor unit is equipped with thermostat (NO contact) for overheat protection. If this protective thermostat activates in normal operation, the deceleration time may be too short. Set the inverter's deceleration time longer.

%ED at short-time rating when braking torque is 100%

| Number of connectable units*5 | | Motor capacity | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 75 kW | 90 kW | 110 kW | 132 kW | 160 kW | 185 kW | 220 kW | 250 kW | 280 kW | 315 kW | 355 kW | 375 kW | 400 kW | 450 kW | 500 kW | 560 kW |
| 200V FR-BU2-55K | 1 | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | 2 | 20 | 15 | 10 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 400V FR-BU2-H75K | 1 | 10 | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | 2 | 40 | 25 | 20 | 10 | 5 | 5 | - | - | - | - | - | - | - | - | - | - |
| 400V FR-BU2-H220K | 1 | 80 | 60 | 40 | 25 | 15 | 10 | 10 | 5 | - | - | - | - | - | - | - | - |
| | 2 | - | - | - | - | - | - | 20 | 20 | 15 | 15 | 15 | 10 | 10 | 10 | 5 | - |
| 400V FR-BU2-H280K | 1 | - | 80 | 65 | 40 | 30 | 20 | 15 | 10 | 10 | 10 | 5 | - | - | - | - | - |
| | 2 | - | - | - | - | - | - | - | - | - | 20 | 20 | 15 | 15 | 15 | 10 | 10 |
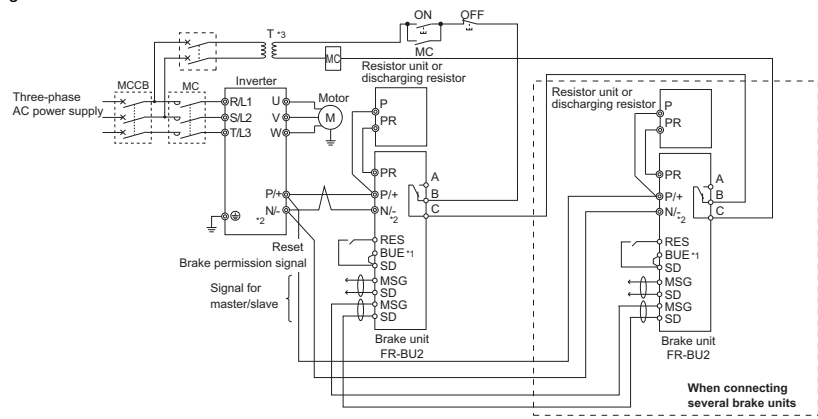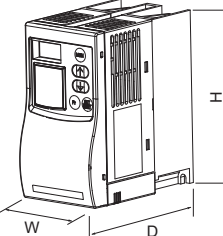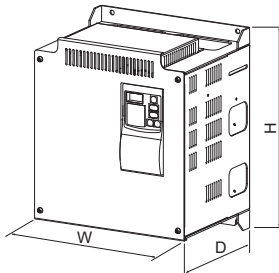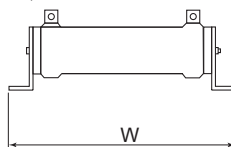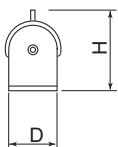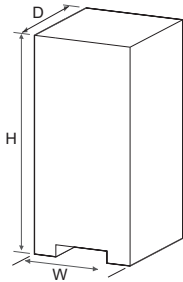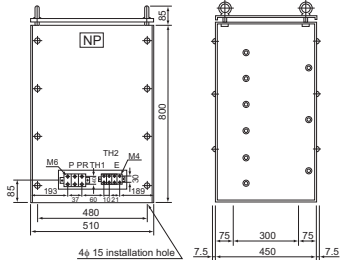
Braking torque (%) in short-time rating of 15s(%)
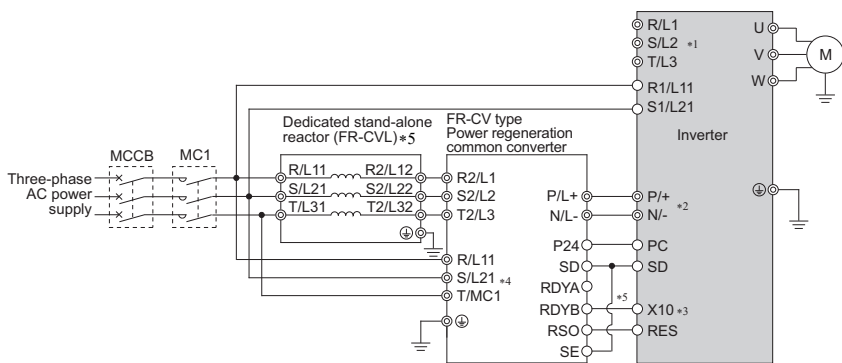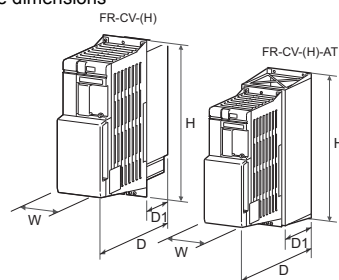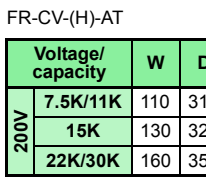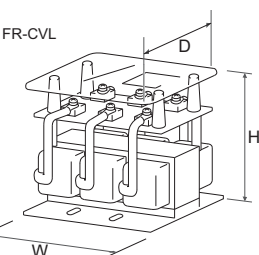
| Number of connectable units*5 | | Motor capacity | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 75 kW | 90 kW | 110 kW | 132 kW | 160 kW | 185 kW | 220 kW | 250 kW | 280 kW | 315 kW | 355 kW | 375 kW | 400 kW | 450 kW | 500 kW | 560 kW |
| 200V FR-BU2-55K | 1 | 70 | 60 | 50 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | 2 | 150 | 120 | 100 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 400V FR-BU2-H75K | 1 | 100 | 80 | 70 | 55 | 45 | 40 | 35 | - | 25 | - | - | 20 | - | - | - | - |
| | 2 | 150 | 150 | 135 | 110 | 90 | 80 | 70 | 60 | 50 | 45 | 40 | 40 | - | - | - | - |
| 400V FR-BU2-H220K | 1 | - | - | 150 | 150 | 135 | 115 | 100 | 80 | 55 | - | - | - | - | - | - | - |
| | 2 | - | - | - | - | - | - | - | - | 150 | 150 | 140 | 120 | 110 | 100 | 90 | 80 |
| 400V FR-BU2-H280K | 1 | - | - | - | - | 150 | 150 | 150 | 125 | 100 | 70 | - | - | - | - | - | - |
| | 2 | - | - | - | - | - | - | - | - | - | - | - | 150 | 150 | 130 | 115 | 100 |

**Left column (Name/model):**
Brake unit
FR-BU2-(H)□K

Resistor unit
FR-BR-(H)□K
MT-BR5-(H)□K

Discharging resistor
GZG type
GRZG type

*5  The number next to the model name indicates the number of connectable units in parallel.
*6  To obtain a large braking torque, the motor has to have a torque characteristic that meets the braking torque. Check the torque characteristic of the motor.

| Name (model) | Specification and Structure |
|---|---|

**Brake unit FR-BU2-(H)□K**

**Resistor unit FR-BR-(H)□K MT-BR5-(H)□K**

**Discharging resistor GZG type GRZG type**

• Connection diagram



∗1  A jumper is connected across BUE and SD in the initial status.
∗2  When wiring, make sure to match the terminal symbol (P/+, N/-) at the inverter side and at the brake unit (FR-BU2) side. Incorrect connection will damage the inverter. (For the FR-F820-00770(18.5K) to 01250(30K), and FR-F840-00470(22K) to 01800(75K), use terminals P3 and N/-.)
   Do not remove the jumper across terminal P/+ and P1 except for connecting the DC reactor.
∗3  When the power supply is 400V class, install a step-down transformer.

• Outline dimensions
<FR-BU2>



FR-BU2-1.5K to 55K
FR-BU2-H7.5K to H75K

FR-BU2-H220K, H280K

| Model | W | H | D |
|---|---|---|---|
| FR-BU2-1.5K to 15K | 68 | 128 | 132.5 |
| FR-BU2-30K | 108 | 128 | 129.5 |
| FR-BU2-55K | 170 | 128 | 142.5 |
| FR-BU2-H7.5K, H15K | 68 | 128 | 132.5 |
| FR-BU2-H30K | 108 | 128 | 129.5 |
| FR-BU2-H55K, H75K | 170 | 128 | 142.5 |
| FR-BU2-H220K, H280K | 250 | 300 | 200 |

(Unit: mm)

<GZG, GRZG>



| Model | W | D | H |
|---|---|---|---|
| GZG300W | 335 | 40 | 78 |
| GRZG200 | 306 | 26 | 55 |
| GRZG300 | 334 | 40 | 79 |
| GRZG400 | 411 | 40 | 79 |

(Unit: mm)

<FR-BR>



| Model | W | H | D |
|---|---|---|---|
| FR-BR-15K | 170 | 450 | 220 |
| FR-BR-30K | 340 | 600 | 220 |
| FR-BR-55K | 480 | 700 | 450 |
| FR-BR-H15K | 170 | 450 | 220 |
| FR-BR-H30K | 340 | 600 | 220 |
| FR-BR-H55K | 480 | 700 | 450 |

(Unit: mm)

<MT-BR5>

| Name (model) | Specification and Structure |
|---|---|
| **Power regeneration common converter FR-CV-(H)□K** | |

Enables continuous regenerative operation at 100% torque. This option can support continuous regenerative operations including line operation.
This converter eliminates the need of preparing brake units per inverter. This converter can cut down the total space and the cost. The regenerated energy is used by another inverter, and if there is still an excess, it is returned to the power supply, saving on the energy consumption.
• Selection method
  Select the model according to capacity of the inverter or the applicable motor, whichever larger.
• Connection diagram



∗1　Remove the jumpers across R/L1 and R/L11 and across S/L2 and S1/L21, and connect the power supply for the control circuit to the terminals R1/L11 and S1/L21. Do not connect anything to the power supply input terminals R/L1, S/L2, and T/L3. Incorrect connection will damage the inverter. Connecting the opposite polarity of terminals N/- and P/+ will damage the inverter.
∗2　Do not install an MCCB for the terminals P/+ and N/- (between terminals P/L+ and P/+ or between N/L- and N/-).
Always match the terminal symbols (P/+, N/-) at the inverter side and at the power regeneration common converter side. Incorrect connection will damage the inverter.
∗3　Assign the X10 signal to a terminal using any of **Pr.178 to Pr.189 (input terminal function selection)**.
∗4　Be sure to connect the power supply and terminals R/L11, S/L21, and T/MC1. Operating the inverter without connecting them will damage the power regeneration common converter.
∗5　Install the dedicated stand-alone reactor (FR-CVL) on a horizontal surface.
∗6　Always connect terminal RDYB of the FR-CV to the inverter terminal where the X10 signal or the MRS signal is assigned to. Always connect terminal SE of the FR-CV to the inverter terminal SD. Not connecting these terminals may damage the FR-CV.

• Outline dimensions

FR-CV-(H)　　　　FR-CV-(H)-AT



**FR-CV-(H)**

| Voltage/capacity | | W | D | D1 | H | Voltage/capacity | | W | D | D1 | H |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 200V | 7.5K/11K | 90 | 303 | 103 | 300 | 400V | 7.5K/11K/15K | 120 | 305 | 105 | 300 |
| | 15K | 120 | 305 | 105 | 300 | | | | | | |
| | 22K/30K | 150 | 322 | 122 | 380 | | 22K/30K | 150 | 305 | 105 | 380 |
| | 37K/55K | 400 | 250 | 135 | 620 | | 37K/55K | 400 | 250 | 135 | 620 |

(Unit: mm)

**FR-CV-(H)-AT**

| Voltage/capacity | | W | D | D1 | H | Voltage/capacity | | W | D | D1 | H |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 200V | 7.5K/11K | 110 | 315 | 115 | 330 | 400V | 7.5K/11K/15K | 130 | 320 | 120 | 330 |
| | 15K | 130 | 320 | 120 | 330 | | | | | | |
| | 22K/30K | 160 | 350 | 150 | 410 | | 22K/30K | 160 | 350 | 150 | 410 |

(Unit: mm)

FR-CVL



**FR-CVL**

| Voltage/capacity | | W | H | D | Voltage/capacity | | W | H | D |
|---|---|---|---|---|---|---|---|---|---|
| 200V | 7.5K/11K/15K | 165 | 155 | 130 | 400V | 7.5K/11K | 220 | 200 | 135 |
| | | | | | | 15K | 220 | 205 | 135 |
| | 22K | 165 | 155 | 140 | | 22K | 220 | 215 | 150 |
| | 30K | 215 | 175 | 160 | | 30K | 245 | 220 | 185 |
| | 37K | 220 | 200 | 320 | | 37K | 245 | 265 | 230 |
| | 55K | 250 | 225 | 335 | | 55K | 290 | 280 | 230 |

(Unit: mm)

| Name (model) | Specification and Structure |
|---|---|
| **Power regeneration converter MT-RC-H[]K** | A power regeneration converter allows energy generated at braking operation of the inverter to be regenerated to the power supply. Since a converter does not require a discharging resistor necessary like a brake unit, it is effective in space and energy saving and it provides a large peak braking torque.<br>• Selection method<br>  Select the model according to the applied motor capacity.<br>• Connection diagram |



• Outline dimensions (Unit mm)

MT-RC-H75K

MT-RC-H160K to H280K



| | Model | W | W1 | W2 | H | H1 | H2 | H3 | D | D1 | C |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **400V** | **MT-RC-H75K** | 480 | 400 | - | 740 | 714 | 13 | 13 | 360 | 196 | 10 |
| | **MT-RC-H160K** | 498 | 400 | 200 | 1010 | 984 | 13 | 13 | 380 | 196 | 10 |
| | **MT-RC-H220K** | 680 | 600 | 300 | 1010 | 984 | 13 | 13 | 380 | 196 | 10 |
| | **MT-RC-H280K** | 790 | 630 | 315 | 1330 | 1300 | 15 | 15 | 440 | 196 | 12 |

MT-RCL



| | Model | W | H | D |
|---|---|---|---|---|
| **400V** | **MT-RCL-H75K** | 390 | 385 | 358 |
| | **MT-RCL-H160K** | 515 | 465 | 380 |
| | **MT-RCL-H220K** | 630 | 655 | 565 |
| | **MT-RCL-H280K** | 690 | 690 | 620 |

| Name (model) | Specification and Structure |
|---|---|

Substantially suppresses power harmonics to obtain the equivalent capacity conversion coefficient K5 = 0 specified in "the Harmonic Suppression Guidelines for Consumers Who Receive High Voltage or Special High Voltage" in Japan.
The power regeneration function comes standard.
The common converter driving with several inverters is possible.
• Selection method
  Select the model according to capacity of the inverter or the applicable motor, whichever larger.
• Specifications

| Model FR-HC2-[] *2 | 200V | | | | | 400V | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 7.5K | 15K | 30K | 55K | 75K | H7.5K | H15K | H30K | H55K | H75K | H110K | H160K | H220K | H280K | H400K | H560K |
| Applicable inverter capacity (LD rating)*1 | 3.7K to 7.5K | 7.5K to 15K | 15K to 30K | 30K to 55K | 37K to 75K | 3.7K to 7.5K | 7.5K to 15K | 15K to 30K | 30K to 55K | 37K to 75K | 55K to 110K | 90K to 160K | 110K to 220K | 160K to 280K | 200K to 400K | 280K to 560K |
| Rated input voltage/ frequency | Three-phase 200V to 220V 50Hz 200V to 230V 60Hz | | | | | Three-phase 380V to 460V 50/60Hz | | | | | | | | | | |
| Rated input current (A) | 33 | 61 | 115 | 215 | 278 | 17 | 31 | 57 | 110 | 139 | 203 | 290 | 397 | 506 | 716 | 993 |

*1  The total capacity of the connected inverters.
*2  If a high power factor converter (FR-HC2) is purchased, it comes with reactor 1 (FR-HCL21), reactor 2 (FR-HCL22), and an outside box (FR-HCB2). Do not connect the DC reactor to the inverter when using a high power factor converter.
(If an H280K or higher is purchased, it comes with FR-HCL21, FR-HCL22, FR-HCC2, FR-HCR2, and FR-HCM2.)

• Outline dimension (Unit mm)

**High power factor converter FR-HC2- (H)[]K**

| Voltage | Capacity | High power factor converter FR-HC2 | | | Reactor 1 FR-HCL21*3 | | | Reactor 2 FR-HCL22*3 | | | Outside box FR-HCB2*4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | W | H | D | W | H | D | W | H | D | W | H | D |
| 200V | 7.5K | 220 | 260 | 170 | 132 | 150 | 100 | 237.5 | 230 | 140 | 190 | 320 | 165 |
| | 15K | 250 | 400 | 190 | 162 | 172 | 126 | 257.5 | 260 | 165 | 190 | 320 | 165 |
| | 30K | 325 | 550 | 195 | 195 | 210 | 150 | 342.5 | 305 | 180 | 270 | 450 | 203 |
| | 55K | 370 | 620 | 250 | 210 | 180 | 200.5 | 432.5 | 380 | 280 | 270 | 450 | 203 |
| | 75K | 465 | 620 | 300 | 240 | 215 | 215.5 | 474 | 460 | 280 | 400 | 450 | 250 |
| 400V | H7.5K | 220 | 300 | 190 | 132 | 140 | 100 | 237.5 | 220 | 140 | 190 | 320 | 165 |
| | H15K | 220 | 300 | 190 | 162 | 170 | 126 | 257.5 | 260 | 165 | 190 | 320 | 165 |
| | H30K | 325 | 550 | 195 | 182 | 195 | 101 | 342.5 | 300 | 180 | 190 | 320 | 165 |
| | H55K | 370 | 670 | 250 | 282.5 | 245 | 165 | 392.5 | 365 | 200 | 270 | 450 | 203 |
| | H75K | 325 | 620 | 250 | 210 | 175 | 210.5 | 430 | 395 | 280 | 300 | 350 | 250 |
| | H110K | 465 | 620 | 300 | 240 | 230 | 220 | 500 | 440 | 370 | 350 | 450 | 380 |
| | H160K | 498 | 1010 | 380 | 280 | 295 | 274.5 | 560 | 520 | 430 | 400 | 450 | 440 |
| | H220K | 498 | 1010 | 380 | 330 | 335 | 289.5 | 620 | 620 | 480 | 400 | 450 | 440 |
| | H280K | 680 | 1010 | 380 | 330 | 335 | 321 | 690 | 700 | 560 | - | - | - |
| | H400K | 790 | 1330 | 440 | 402 | 460 | 550 | 632 | 675 | 705 | - | - | - |
| | H560K | 790 | 1330 | 440 | 452 | 545 | 645 | 632 | 720 | 745 | - | - | - |

High power factor converter

Reactor 1, Reactor 2

Outside box
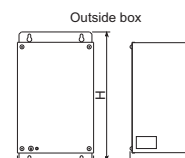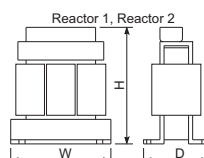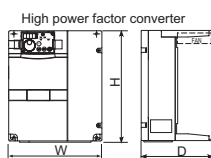
*3  Install reactors (FR-HCL21 and 22) on a horizontal surface.
*4  The H280K or higher are not equipped with FR-HCB2. A filter capacitor and inrush current limit resistors are provided instead.

Features

Application Example
PLC Function
FR Configurator2

Connection Examples

Standard Specs

Outline Dimensions

Terminal Connection Diagrams
Terminal Specs

Operation Panel

Operation Steps

Parameter List

Protective Functions

Options

LVS/Cables

Precautions

Motors

Compatibility

Warranty
Inquiry

| Name (model) | Specification and Structure |
|---|---|

A surge voltage suppression filter limits surge voltage applied to motor terminals when driving the 400 V class motor by the inverter.
• Selection method
  Select the model according to the applied motor capacity.
• Specifications

| Model FR-ASF-[] | 400V | | | | | | |
|---|---|---|---|---|---|---|---|
| | H1.5K | H3.7K | H7.5K | H15K | H22K | H37K | H55K |
| Applicable motor capacity (kW) | 0.4 to 1.5 | 2.2 to 3.7 | 5.5 to 7.5 | 11 to 15 | 18.5 to 22 | 30 to 37 | 45 to 55 |
| Rated input current (A) | 4.0 | 9.0 | 17.0 | 31.0 | 43.0 | 71.0 | 110.0 |
| Overload current rating *1 | 150% 60 s, 200% 0.5 s | | | | | | |
| Rated input AC voltage *1 | Three-phase 380 V to 460 V 50 Hz/60 Hz | | | | | | |
| Maximum AC voltage fluctuation *1 | Three-phase 506 V 50 Hz/60 Hz | | | | | | |
| Maximum frequency *1 | 400 Hz | | | | | | |
| PWM frequency permissible range | 0.5 kHz to 14.5 kHz | | | | | | |
| Maximum wiring length between the filter-motor | 300 m | | | | | | |
| Approx. mass (kg) | 8.0 | 11.0 | 20.0 | 28.0 | 38.0 | 59.0 | 78.0 |
| Environment — Surrounding air temperature | -10°C to +50°C (non-freezing) | | | | | | |
| Environment — Surrounding air humidity | 90% RH or less (non-condensing) | | | | | | |
| Environment — Atmosphere | Indoors (without corrosive gas, flammable gas, oil mist, dust and dirt, etc.) | | | | | | |
| Environment — Altitude/vibration | Maximum 1000 m above sea level, 5.9 m/s$^2$ or less at 10 to 55 Hz (directions of X, Y, Z axes) | | | | | | |

*1  Determined by the specification of the connected inverter (400V class).

• Connection diagram



• Outline dimension (Unit mm)



| Model | W | H*1 | D*1 |
|---|---|---|---|
| FR-ASF-H1.5K | 220 | 193 | 160 |
| FR-ASF-H3.7K | 220 | 200 | 180 |
| FR-ASF-H7.5K | 280 | 250 | 215 |
| FR-ASF-H15K *2 | 335 | 260 | 285 |
| FR-ASF-H22K *2 | 335 | 340 | 349 |
| FR-ASF-H37K *2 | 375 | 445 | 388 |
| FR-ASF-H55K *2 | 395 | 445 | 568 |

*1  This indicates the maximum dimension.
*2  The H15K or higher has a different shape.

**Surge voltage suppression filter FR-ASF-H[]K**

| Name (model) | Specification and Structure |
|---|---|

Limits surge voltage applied to motor terminals when driving a 400 V class motor with an inverter.
This filter is compatible with the 5.5 to 37 kW motors.
• Selection method
Select the model according to the applied motor capacity.
• Specifications

| Model FR-BMF-H□K | | 7.5 | | 15 | | 22 | | 37 | |
|---|---|---|---|---|---|---|---|---|---|
| Applicable motor capacity (kW) *1 | | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 |
| Rated current (A) | | 17 | | 31 | | 43 | | 71 | |
| Overload current rating*2 | | 150% 60s, 200% 0.5s (inverse-time characteristics) | | | | | | | |
| Rated AC input voltage*2 | | Three-phase 380 to 480V | | | | | | | |
| Permissible AC voltage fluctuation*2 | | 323 to 528V | | | | | | | |
| Maximum frequency*2 | | 120Hz | | | | | | | |
| PWM carrier frequency | | 2kHz or lower*3 | | | | | | | |
| Protective structure (JEM 1030) | | Open type (IP00) | | | | | | | |
| Cooling system | | Self-cooling | | | | | | | |
| Maximum wiring length | | 100m or lower | | | | | | | |
| Approx. mass (kg) | | 5.5 | | 9.5 | | 11.5 | | 19 | |
| Environment | Surrounding air temperature | -10°C to +50°C (non-freezing) | | | | | | | |
| | Surrounding air humidity | 90% RH or less (non-condensing) | | | | | | | |
| | Atmosphere | Indoors (without corrosive gas, flammable gas, oil mist, dust and dirt, etc.) | | | | | | | |
| | Altitude/vibration | Maximum 1000 m above sea level, 5.9 m/s$^2$ or less*4 at 10 to 55 Hz (directions of X, Y, Z axes) | | | | | | | |

*1 Indicates the maximum capacity applicable with the Mitsubishi 4-pole standard motor. (IPM motors are not applicable.
*2 Determined by the specification of the connected inverter (400V class).
*3 Set the **Pr.72 PWM frequency selection** to 2 kHz or less.
*4 When an inverter has a filter mounted on its back, do not use such an inverter on a moving object or in a place that vibrates (exceeding 1.96m/s$^2$).

• Connection diagram
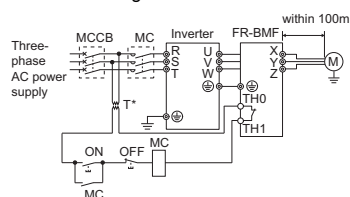


* Install a step-down transformer.

• Outline dimension (Unit mm)

FR-BMF-H7.5K
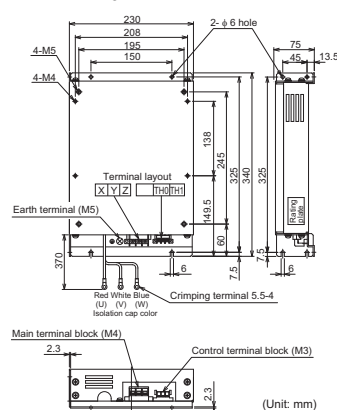


FR-BMF-H15K, H22K



FR-BMF-H37K



**Surge voltage suppression filter FR-BMF-H□K**

| Name (model) | Specification and Structure |
|---|---|
| Sine wave filter MT-BSL-(H)□K MT-BSC-(H)□K | • Sine wave filter application<br>A sine wave filter can be installed to adjust the motor voltage and current waveforms to be sine waves. Install a sine wave filter to the output side of the inverter . This filter is compatible with the FR-F820-03160(75K) or higher and the FR-F840-01800(75K) or higher.<br>(This product is available only with general-purpose motors.) A sine wave filter will bring operation characteristic equivalent to the operation with a sine wave power supply and also will provide the following benefits. A sine wave filter will bring operation characteristic equivalent to the operation with a sine wave power supply and also will provide the following benefits.<br>(a) Low noise<br>(b) No surge current<br>(c) Small motor losses (for a standard motor)<br>• Operating condition<br>The following settings and conditions are required to use a sine wave filter.<br>(a) Set "25" in **Pr.72**. (The initial value is "2".)<br>This setting changes the carrier frequency to 2.5kHz. (A sine wave filter is designed on the assumption of 2.5kHz carrier frequency. Always change this setting.) The operation with **Pr.72** = "25" setting may damage inverter and the sine wave filter.<br>(b) A sine wave filter can be used for the operation with an inverter output frequency of 60Hz or lower.<br>It cannot be used for the operation with higher frequency. (Using it with the higher frequency will increases the filter loss.)<br>(c) It is applicable only under V/F control. (When **Pr.72** = "25", V/F control is automatically set.)<br>(d) When using the sine wave filter and FR-HC2 together, use MT-BSL-HC.<br>• Circuit configuration and connection |



| Motor capacity (kW) | | Model | | Applicable inverter |
|---|---|---|---|---|
| | | Reactor for filter | Capacitor for filter*1 | |
| 200V | 75 | MT-BSL-75K | 1×MT-BSC-75K | Select an inverter where the rated motor current × 1.1 will be 90% or less of the rated inverter current. |
| | 90 | MT-BSL-90K | 1×MT-BSC-90K | |
| 400V | 75 | MT-BSL-H75K(-HC) | 1×MT-BSC-H75K | |
| | 90 | MT-BSL-H110K(-HC) | 1×MT-BSC-H110K | |
| | 110 | MT-BSL-H110K(-HC) | 1×MT-BSC-H110K | |
| | 132 | MT-BSL-H150K(-HC) | 2×MT-BSC-H75K | |
| | 160 | MT-BSL-H220K(-HC) | 2×MT-BSC-H110K | |
| | 185 | MT-BSL-H220K(-HC) | 2×MT-BSC-H110K | |
| | 220 | MT-BSL-H220K(-HC) | 2×MT-BSC-H110K | |
| | 250 | MT-BSL-H280K(-HC) | 3×MT-BSC-H110K | |
| | 280 | MT-BSL-H280K(-HC) | 3×MT-BSC-H110K | |

*1 When using two capacitors, install them in parallel as shown in the wiring diagram.

• Reactor for sine wave filter



* Remove the eye nut after installation of the product.
This is a sample of the outer appearance, which differs depending on the model.

| | Model | A | B | C | D | E | F | G | H | Mass (kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| 200V | MT-BSL-75K | 330 | 150 | 285 | 185 | 216 | 328 | M10 | M12 | 80 |
| | MT-BSL-90K | 390 | 150 | 320 | 180 | 220 | 330 | M12 | M12 | 120 |
| 400V | MT-BSL-H75K | 330 | 150 | 285 | 185 | 216 | 318 | M10 | M10 | 80 |
| | MT-BSL-H75K-HC | 385 | 150 | 345 | 185 | 216 | 315 | M10 | M10 | 110 |
| | MT-BSL-H110K | 390 | 150 | 340 | 195 | 235 | 368 | M12 | M12 | 140 |
| | MT-BSL-H110K-HC | 420 | 170 | 400 | 195 | 235 | 370 | M12 | M12 | 180 |
| | MT-BSL-H150K | 455 | 200 | 397 | 200 | 240 | 380 | M12 | M12 | 190 |
| | MT-BSL-H150K-HC | 450 | 300 | 455 | 390 | 430 | 500 | M12 | M12 | 250 |
| | MT-BSL-H220K | 495 | 200 | 405 | 250 | 300 | 420 | M12 | M12 | 240 |
| | MT-BSL-H220K-HC | 510 | 350 | 540 | 430 | 485 | 555 | M12 | M12 | 310 |
| | MT-BSL-H280K | 575 | 200 | 470 | 310 | 370 | 485 | M12 | M12 | 340 |
| | MT-BSL-H280K-HC | 570 | 400 | 590 | 475 | 535 | 620 | M12 | M12 | 480 |

Install the reactor on a horizontal surface.

• Capacitor for sine wave filter



| | Model | A | B | C | D | E | F | G | H | I | Mass(kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 200V | MT-BSC-75K | 207 | 191 | 285 | 233 | 72 | 41 | 45 | φ7 | M8 | 3.9 |
| | MT-BSC-90K | 282 | 266 | 240 | 183 | 92 | 56 | 85 | φ7 | M12 | 5.5 |
| 400V | MT-BSC-H75K | 207 | 191 | 220 | 173 | 72 | 41 | 55 | φ7 | M6 | 3.0 |
| | MT-BSC-H110K | 207 | 191 | 280 | 233 | 72 | 41 | 55 | φ7 | M6 | 4.0 |

When installing, allow 25 mm or more gap between capacitors.
• Recommended cable gauge
The gauge of the cables used between inverter and MT-BSL as well as MT-BSL and induction motor varies according to U, V, and W as indicated on **page 98**.
The following table shows the cable gauge of the MT-BSC connecting cable.

| MT-BSC-75K | MT-BSC-90K | MT-BSC-H75K | MT-BSC-H110K |
|---|---|---|---|
| 38 mm$^2$ | 38 mm$^2$ | 22 mm$^2$ | 22 mm$^2$ |

# Low-Voltage Switchgear/Cables

## ● Mitsubishi Molded Case Circuit Breakers and Earth Leakage Circuit Breakers WS-V Series

"WS-V Series" is the new circuit breakers that have a lot of superior aspects such as higher breaking capacity, design for easy use, standardization of accessory parts, and compliance to the global standards.

### ◆ Features

#### ◆ Technologies based on long years of experience are brought together to achieve improved performance

The new circuit breaking technology "Expanded ISTAC" has improved the currentlimiting performance and upgraded the overall breaking capacity.
Expansion of the conductor under the stator shortens the contact parting time of the mover as compared to the conventional ISTAC structure.
The current-limiting performance has been improved remarkably. (The maximum peak current value has been reduced by approx. 10%.)

New circuit breaking technology (Expanded ISTAC)



Grid
Movable conductor
Arc
Current C
Current
Increased reaction force of movable conductor
Reaction circuit
Current B
Fixed conductor

#### ◆ Compact design for ease of use

The thermal adjustable circuit breakers and electronic circuit breakers are smaller.

NF250-SGW

NF250-SGV
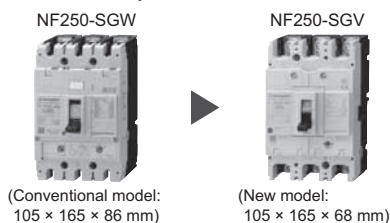
## Volume ratio 79%
(Compared with our conventional models)

(Conventional model: 105 × 165 × 86 mm)

(New model: 105 × 165 × 68 mm)

#### ◆ Types of internal accessories are reduced from 3 types to 1 type

Standardization of internal accessories contributes to a reduction of stock and delivery time.

Conventional models — Three types

For 32/63AF

For 125AF

For 250AF

New models — One type — For 32 to 250AF

Applicable accessories
●AL  ●AX  ●AL+AX  ●SHT  ●UVT

■ Breaking capacity comparison with a conventional model



Model Name

250-RG — 20% UP
250-H — 50% UP
250-S — 20% UP
250-C — 38.8% UP
125-RG — 20% UP

WS-V Series
WS Series

kA at 400 V AC Icu
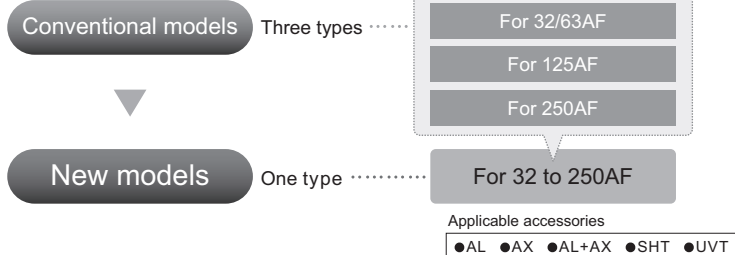
#### ◆ Lineup of UL 489 listed circuit breakers with 54 mm width "Small Fit"  (F) Style

The compact breakers contribute to a size reduction of machines, and IEC 35 mm rail mounting is standard.

NF50-SVFU

NF100-CVFU

NV50-SVFU

NV100-CVFU
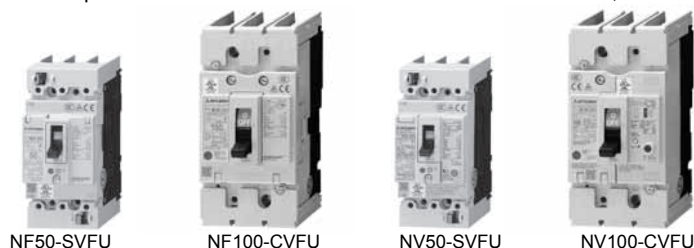
For security and standard compliance of machines, F-type and V-type operating handles are available for breakers with 54 mm width.

#### ◆ Lineup of UL 489 listed circuit breakers for 480 V AC "High Performance"

The breaking capacity has been improved to satisfy the request for SCCR upgrading.

NF125-SVU

NF125-HVU
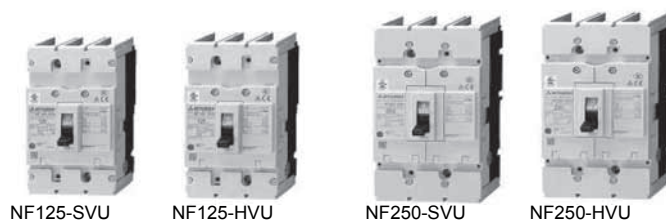
NF250-SVU

NF250-HVU

Breaking capacity of UL 489 listed circuit breakers for 480 V AC (UL 489)
NF125-SVU/NV125-SVU ................................30 kA
NF125-HVU/NV125-HVU ................................50 kA
NF250-SVU/NV250-SVU ................................35 kA
NF250-HVU/NV250-HVU ................................50 kA
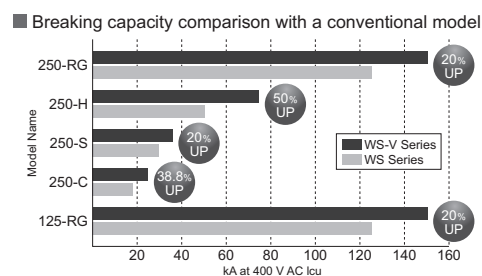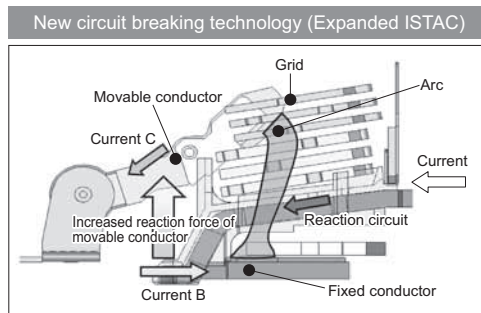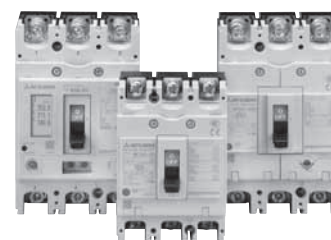
Features

Application Example PLC Function FR Configurator2

Connection Examples

Standard Specs

Outline Dimensions

Terminal Connection Diagrams Terminal Specs

Operation Panel

Operation Steps

Parameter List

Protective Functions

Options

LVS/Cables

Precautions

Motors

Compatibility

Warranty Inquiry

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## ● Mitsubishi Magnetic Motor Starters and Magnetic Contactors MS-T Series

MS-T series is newly released!
The MS-T series is smaller than ever, enabling more compact control panel. The MS-T series is suitable for other Mitsubishi FA equipment. In addition, the MS-T conforms to a variety of global standards, supporting the global use.

S-T10

### ◆ Features

#### ◆ Compact

Just 36 mm wide for 10 A-frame type!
General-purpose magnetic contactor with smallest width∗1 in the industry.
The width of MS-T series is reduced by 32% as compared to the prior MS-N series, enabling a more compact panel.

  ∗1    Based on Mitsubishi Electric research as of October 2013 in the general-purpose magnetic contactor industry for 10 A-frame class.

[Unit: mm]

| Frame size | | 11 A | 13 A | | 20 A | 25 A |
|---|---|---|---|---|---|---|
| MS-N series | Front view | 43 S-N10 | 43 S-N11 (Auxiliary 1-pole) | 53 S-N12 (Auxiliary 2-pole) | 63 S-N20 | 75 S-N25 |
| New MS-T series | Front view | 36 S-T10 -7 mm! | 43 S-T12 (Auxiliary 2-pole) -10 mm! | | 43 S-T20 -20 mm! | 63 S-T25 -12 mm! |

#### ◆ Standardization

• Covers provided as standard equipment
  Terminal cover and auxiliary contact unit covers are provided as standard equipment. Not only ensuring your safety, but also saving you time and cost of selecting and purchasing the covers separately.

• Wide-ranged operation coil rating
  The prior series had 14 types of the operation coil rating. Owing to the wide-ranged operation coil rating, the number of the rating types for the MS-T series is reduced to half, making it easier to select as compared to the prior model. Consolidating the number of the produced coils type allows not just the reduction of customer storage, but also shortening of delivery time.

Covers + Contactor

Covers are attached as standard.
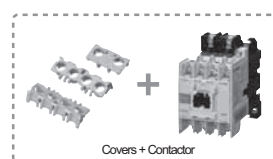
| Coil designation | Rated voltage [V] | |
|---|---|---|
| | 50 Hz | 60 Hz |
| AC12 V | 12 | 12 |
| AC24 V | 24 | 24 |
| AC48 V | 48 to 50 | 48 to 50 |
| AC100 V | 100 | 100 to 110 |
| AC120 V | 110 to 120 | 115 to 120 |
| AC127 V | 125 to 127 | 127 |
| AC200 V | 200 | 200 to 220 |
| AC220 V | 208 to 220 | 220 |
| AC230 V | 220 to 240 | 230 to 240 |
| AC260 V | 240 to 260 | 260 to 280 |
| AC380 V | 346 to 380 | 380 |
| AC400 V | 380 to 415 | 400 to 440 |
| AC440 V | 415 to 440 | 460 to 480 |
| AC500 V | 500 | 500 to 550 |

| Coil designation | Rated voltage [V] |
|---|---|
| | 50 Hz/60 Hz |
| AC24 V | 24 |
| AC48 V | 48 to 50 |
| AC100 V | 100 to 127 |
| AC200 V | 200 to 240 |
| AC300 V | 260 to 300 |
| AC400 V | 380 to 440 |
| AC500 V | 460 to 550 |

(12 V type is an order-made product.)

#### ◆ Global Standard

• Conforms to various global standards
  Not only major global standards such as IEC, JIS, UL, CE, and CCC but also ship standards and other country standards are planned to be certified.

⊙: Compliant as standard

| Model | Applicable Standard | | | | Safety Standard | | EC Directive | Certification Body | CCC |
|---|---|---|---|---|---|---|---|---|---|
| | IEC | JIS | DIN/VDE | BS/EN | UL | CSA | CE Marking | TÜV | GB |
| | International | Japan | Germany | England Europe | U.S.A | Canada | Europe | Germany | China |
| S-T10 to S-T32 MSO-T10 to MSO-T25 TH-T18(KP) to TH-T25(KP) | ⊙ | ⊙ | ⊙ | ⊙ | ⊙ | ⊙ | ⊙ | ⊙ | ⊙ |

## ● Mitsubishi Magnetic Motor Starters and Magnetic Contactors MS-N Series

Environment-friendly Mitsubishi MS-N series ensures safety and conforms to various global standards. Its compact size contributes to space-saving in a machine. The MS-N series is suitable for other Mitsubishi FA equipment and can be used globally.
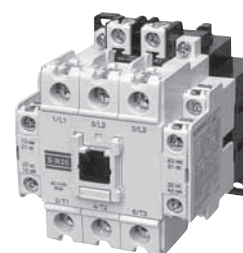
S-N35CX

### ◆ Features

#### ◆ Bifurcated contact adopted to achieve high contact reliability
Contact reliability is greatly improved by combining bifurcated moving contact and stationary contact.
This series responds to the various needs such as the application to safety circuit.
(The MS-T series also has bifurcated contacts.)

#### ◆ Mirror contact (auxiliary contact off at main contact welding)
The MS-N series meets requirements of "Control functions in the event of failure" described in EN 60204-1 "Electrical equipment of machines", being suitable as interlock circuit contact. The MS-N series is applicable for category 4 safety circuit. We ensure safety for our customers.
(The MS-T series also has mirror contacts.)

Main contact welding
Auxiliary normally closed contact
Gap

#### ◆ Various option units
Various options including surge absorbers and additional auxiliary contact blocks are available.

#### ◆ Conforms to various global standards

⊙: Compliant as standard

| Model | Applicable Standard | | | | Safety Standard | | EC Directive | Certification Body | CCC |
|---|---|---|---|---|---|---|---|---|---|
| | IEC | JIS | DIN/VDE | BS/EN | UL | CSA | CE Marking | TÜV | GB |
| | International | Japan | Germany | England Europe | U.S.A | Canada | Europe | Germany | China |
| S-N10 to S-N400 MSO-N10 to MSO-N400 TH-N12KP to TH-N400KP | ⊙ | ⊙ | ⊙ | ⊙ | ⊙ | ⊙ | ⊙ | ⊙ | ⊙ |
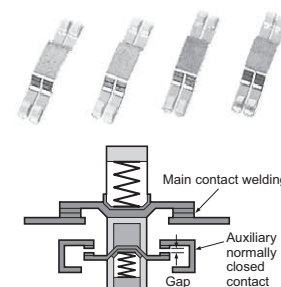
## ● Selecting the rated sensitivity current for the earth leakage circuit breaker

When using an earth leakage circuit breaker with the inverter circuit, select its rated sensitivity current as follows, independently of the PWM carrier frequency.

- Breaker designed for harmonic and surge suppression
  Rated sensitivity current
  $I\Delta n \geq 10 \times (Ig1+Ign+Igi+Ig2+Igm)$
- Standard breaker
  Rated sensitivity current
  $I\Delta n \geq 10 \times \{Ig1+Ign+Igi+3 \times (Ig2+Igm)\}$
  Ig1, Ig2: Leakage currents in wire path during commercial power supply operation
  Ign: Leakage current of inverter input side noise filter
  Igm: Leakage current of motor during commercial power supply operation
  Igi: Leakage current of inverter unit

<Example>
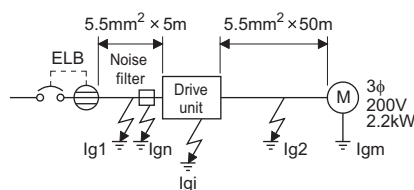
(a) Install the earth leakage circuit breaker (ELB) on the input side of the inverter.
(b) In the 人 connection earthed-neutral system, the sensitivity current is blunt against a ground fault in the inverter output side. Earthing (Grounding) must conform to the requirements of national and local safety regulations and electrical codes. (NEC section 250, IEC 536 class 1 and other applicable standards)

Example of leakage current of cable path per 1km during the commercial power supply operation when the CV cable is routed in metal conduit (200V 60Hz)
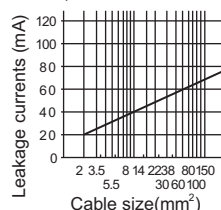
Leakage current example of three-phase induction motor during the commercial power supply operation (200V 60Hz)
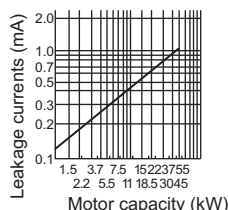
Example of leakage current per 1km during the commercial power supply operation when the CV cable is routed in metal conduit
(Three-phase three-wire delta connection 400V60Hz)
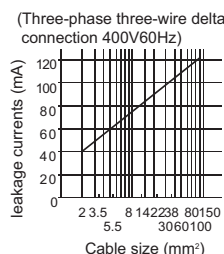
Leakage current example of three-phase induction motor during the commercial power supply operation
(Totally-enclosed fan-cooled type motor 400V60Hz)
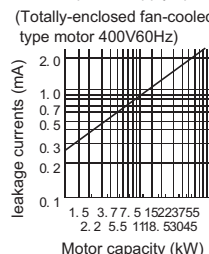
For "人" connection, the amount of leakage current is appox.1/3 of the above value.

◆ **Selection example (in the case of the above figure)**

| | Breaker designed for harmonic and surge suppression | Standard breaker |
|---|---|---|
| Leakage current Ig1 (mA) | $33 \times \dfrac{5m}{1000m} = 0.17$ | |
| Leakage current Ign (mA) | 0 (without noise filter) | |
| Leakage current Igi (mA) | 1 (without EMC filter) Refer to the following table for the leakage current of the inverter.[*1] | |
| Leakage current Ig2 (mA) | $33 \times \dfrac{50m}{1000m} = 1.65$ | |
| Motor leakage current Igm (mA) | 0.18 | |
| Total leakage current (mA) | 3.00 | 6.66 |
| Rated sensitivity current (mA) ($\geq$Ig × 10) | 30 | 100 |

*1 For whether to use the EMC filter or not, refer to the Instruction Manual (Detailed).

◆ **Inverter/converter unit leakage current**

200 V class (Input power supply conditions: 220 V/60 Hz, power supply unbalance: within 3%)

| Inverter | FR-F800 (Standard model) | |
|---|---|---|
| EMC filter | ON | OFF |
| Phase earthing (grounding) | 22 | 1 |

(mA)

400 V class (Input power supply conditions: 440 V/60 Hz, power supply unbalance: within 3%)

| Inverter/ converter unit | FR-F800 (Standard model) | | FR-F802 (Separated converter type) | Converter unit FR-CC2 | | | |
|---|---|---|---|---|---|---|---|
| | | | | H355K | | H400K to H630K | |
| EMC filter | ON | OFF | — | ON | OFF | ON | OFF |
| Phase earthing (grounding) | 35 | 2 | 2 | 35 | 2 | 70 | 2 |
| Earthed-neutral system | 2 | 1 | 1 | 2 | 1 | 2 | 1 |

(mA)

## ● Molded case circuit breaker, magnetic contactor, cable gauge

### ◆ 315K or lower

| Voltage | Motor output (kW) *1 | Applicable inverter model (LD rating) | Molded case circuit breaker (MCCB) *2 or earth leakage circuit breaker (ELB) (NF, NV type) | | Input side magnetic contactor *3 | | Recommended Cable gauge(mm²) *4 | |
|---|---|---|---|---|---|---|---|---|
| | | | Power factor improving (AC or DC) reactor connection | | Power factor improving (AC or DC) reactor connection | | R/L1, S/L2, T/L3 | U, V, W |
| | | | Without | With | Without | With | | |
| 200 V class | 0.75 | FR-F820-00046(0.75K) | 10A | 10A | S-T10 | S-T10 | 2 | 2 |
| | 1.5 | FR-F820-00077(1.5K) | 15A | 15A | S-T10 | S-T10 | 2 | 2 |
| | 2.2 | FR-F820-00105(2.2K) | 20A | 15A | S-T10 | S-T10 | 2 | 2 |
| | 3.7 | FR-F820-00167(3.7K) | 30A | 30A | S-T21 | S-T10 | 3.5 | 3.5 |
| | 5.5 | FR-F820-00250(5.5K) | 50A | 40A | S-N25 | S-T21 | 5.5 | 5.5 |
| | 7.5 | FR-F820-00340(7.5K) | 60A | 50A | S-N25 | S-N25 | 14 | 8 |
| | 11 | FR-F820-00490(11K) | 75A | 75A | S-N35 | S-N35 | 14 | 14 |
| | 15 | FR-F820-00630(15K) | 125A | 100A | S-N50 | S-N50 | 22 | 22 |
| | 18.5 | FR-F820-00770(18.5K) | 150A | 125A | S-N65 | S-N50 | 38 | 38 |
| | 22 | FR-F820-00930(22K) | 175A | 150A | S-N80 | S-N65 | 38 | 38 |
| | 30 | FR-F820-01250(30K) | 225A | 175A | S-N95 | S-N80 | 60 | 60 |
| | 37 | FR-F820-01540(37K) | 250A | 225A | S-N150 | S-N125 | 80 | 80 |
| | 45 | FR-F820-01870(45K) | 300A | 300A | S-N180 | S-N150 | 100 | 100 |
| | 55 | FR-F820-02330(55K) | 400A | 350A | S-N220 | S-N180 | 100 | 100 |
| | 75 | FR-F820-03160(75K) | - | 400A | - | S-N300 | 125 | 125 |
| | 90 | FR-F820-03800(90K) | - | 400A | - | S-N300 | 150 | 150 |
| | 110 | FR-F820-04750(110K) | - | 500A | - | S-N400 | 150 | 150 |
| 400 V class | 0.75 | FR-F840-00023(0.75K) | 5A | 5A | S-T10 | S-T10 | 2 | 2 |
| | 1.5 | FR-F840-00038(1.5K) | 10A | 10A | S-T10 | S-T10 | 2 | 2 |
| | 2.2 | FR-F840-00052(2.2K) | 10A | 10A | S-T10 | S-T10 | 2 | 2 |
| | 3.7 | FR-F840-00083(3.7K) | 20A | 15A | S-T10 | S-T10 | 2 | 2 |
| | 5.5 | FR-F840-00126(5.5K) | 30A | 20A | S-T21 | S-T12 | 2 | 2 |
| | 7.5 | FR-F840-00170(7.5K) | 30A | 30A | S-T21 | S-T21 | 3.5 | 3.5 |
| | 11 | FR-F840-00250(11K) | 50A | 40A | S-T21 | S-T21 | 5.5 | 5.5 |
| | 15 | FR-F840-00310(15K) | 60A | 50A | S-N25 | S-T21 | 8 | 8 |
| | 18.5 | FR-F840-00380(18.5K) | 75A | 60A | S-N25 | S-N25 | 14 | 8 |
| | 22 | FR-F840-00470(22K) | 100A | 75A | S-N35 | S-N25 | 14 | 14 |
| | 30 | FR-F840-00620(30K) | 125A | 100A | S-N50 | S-N50 | 22 | 22 |
| | 37 | FR-F840-00770(37K) | 150A | 125A | S-N65 | S-N50 | 22 | 22 |
| | 45 | FR-F840-00930(45K) | 175A | 150A | S-N80 | S-N65 | 38 | 38 |
| | 55 | FR-F840-01160(55K) | 200A | 175A | S-N80 | S-N80 | 60 | 60 |
| | 75 | FR-F840-01800(75K) | - | 225A | - | S-N95 | 60 | 60 |
| | 90 | FR-F840-02160(90K) | - | 225A | - | S-N150 | 60 | 60 |
| | 110 | FR-F840-02600(110K) | - | 225A | - | S-N180 | 80 | 80 |
| | 132 | FR-F840-03250(132K) | - | 400A | - | S-N220 | 100 | 100 |
| | 150 | FR-F840-03610(160K) | - | 400A | - | S-N300 | 125 | 150 |
| | 160 | FR-F840-03610(160K) | - | 400A | - | S-N300 | 125 | 150 |
| | 185 | FR-F840-04320(185K) | - | 400A | - | S-N300 | 150 | 150 |
| | 220 | FR-F840-04810(220K) | - | 500A | - | S-N400 | 2×100 | 2×100 |
| | 250 | FR-F840-05470(250K) | - | 600A | - | S-N600 | 2×100 | 2×100 |
| | 280 | FR-F840-06100(280K) | - | 600A | - | S-N600 | 2×125 | 2×125 |
| | 315 | FR-F840-06830(315K) | - | 700A | - | S-N600 | 2×150 | 2×150 |

*1 Assumes the use of an IPM motor MM-EFS, MM-THE4 or a Mitsubishi 4-pole standard motor with the motor capacity of 200 VAC 50 Hz.

*2 Select an MCCB according to the power supply capacity.
Install one MCCB per inverter.
For the use in the United States or Canada, provide the appropriate UL and cUL listed fuse or UL489 molded case circuit breaker (MCCB) that is suitable for branch circuit protection. **(Refer to the Instruction Manual (Detailed).)**

*3 The magnetic contactor is selected based on the AC-1 class. The electrical durability of magnetic contactor is 500,000 times. When the magnetic contactor is used for emergency stops during motor driving, the electrical durability is 25 times.
If using an MC for emergency stop during motor driving or using it on the motor side during commercial power supply operation, select an MC with the class AC-3 rated current for the rated motor current.

*4 Cables
For FR-F820-02330(55K) or lower and FR-F840-01160(55K) or lower, it is the gauge of a cable with the continuous maximum permissible temperature of 75°C. (HIV cable (600 V grade heat-resistant PVC insulated wire), etc.) It assumes a surrounding air temperature of 50°C or lower and the wiring distance of 20 m or shorter.
For FR-F820-03160(75K) or higher and FR-F840-01800(75K) or higher, it is the gauge of the cable with the continuous maximum permissible temperature of 90°C or higher. (LMFC (heat resistant flexible cross-linked polyethylene insulated cable), etc.) It assumes a surrounding air temperature of 50°C or lower and in-enclosure wiring.

**NOTE**

- When the inverter capacity is larger than the motor capacity, select an MCCB and a magnetic contactor according to the inverter model, and select cables and reactors according to the motor output.
- When the breaker on the inverter's input side trips, check for the wiring fault (short circuit), damage to internal parts of the inverter etc. The cause of the trip must be identified and removed before turning ON the power of the breaker.
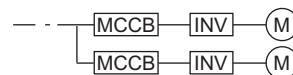
## ◆ 355K or higher

| Voltage | Motor output (kW)[*1] | Applicable inverter model (LD rating) | Applicable converter model | Molded case circuit breaker (MCCB)[*2] or earth leakage circuit breaker (ELB) (NF, NV type) | Input-side magnetic contactor[*3] | HIV cables, etc. (mm$^2$)[*4] | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | R/L1, S/L2, T/L3 | P/+, N/- | U, V, W |
| 400 V class | 355 | FR-F842-07700(355K) | FR-CC2-H355K | 800A | S-N600 | 2×200 | 2×150 | 2×200 |
| | 400 | FR-F842-08660(400K) | FR-CC2-H400K | 900A | S-N800 | 2×200 | 2×200 | 2×200 |
| | 450 | FR-F842-09620(450K) | FR-CC2-H450K | 1000A | 1000A rated product | 2×250 | 2×200 | 2×250 |
| | 500 | FR-F842-10940(500K) | FR-CC2-H500K | 1200A | 1000A rated product | 3×200 | 2×250 | 2×250 |
| | 560 | FR-F842-12120(560K) | FR-CC2-H560K | 1500A | 1200A rated product | 3×200 | 3×200 | 3×200 |
| | 630 | FR-F842-12120(560K) [*5] | FR-CC2-H630K | 2000A | 1400A rated product | 3×200 | 3×200 | 3×200 |

*1 Assumes the use of a Mitsubishi 4-pole standard motor with the motor capacity of 400 VAC 50 Hz.

*2 Select an MCCB according to the power supply capacity.
Install one MCCB per converter.
For the use in the United States or Canada, provide the appropriate UL and cUL listed fuse or UL489 molded case circuit breaker (MCCB) that is suitable for branch circuit protection. (Refer to the Instruction Manual (Detailed) of the inverter.)

MCCB — Converter unit — INV — M
MCCB — Converter unit — INV — M

*3 The magnetic contactor is selected based on the AC-1 class. The electrical durability of magnetic contactor is 500,000 times. When the magnetic contactor is used for emergency stops during motor driving, the electrical durability is 25 times.
If using an MC for emergency stop during driving the motor, select an MC regarding the converter unit input side current as JEM1038-AC-3 class rated current. When using an MC on the inverter output side for commercial-power supply operation switching using a general-purpose motor, select an MC regarding the rated motor current as JEM1038-AC-3 class rated current.

*4 The gauge of the cable with the continuous maximum permissible temperature of 90°C or higher. (LMFC (heat resistant flexible cross-linked polyethylene insulated cable), etc.). It assumes a surrounding air temperature of 40°C or lower and in-enclosure wiring.

*5 This can be used when the SLD rating is selected for the FR-F842-12120(560K).

**NOTE**

• When the converter unit capacity is larger than the motor capacity, select an MCCB and a magnetic contactor according to the converter unit model, and select cables and reactors according to the motor output.
• When the breaker on the converter unit's input side trips, check for the wiring fault (short circuit), damage to internal parts of the inverter and the converter unit, etc. The cause of the trip must be identified and removed before turning ON the power of the breaker.

# � Precaution on Selection and Operation

## ● Precautions for use

### ◆ ⚠ Safety instructions

- To use the product safely and correctly, make sure to read the "Instruction Manual" before the use.
- This product has not been designed or manufactured for use with any equipment or system operated under life-threatening conditions.
- Please contact our sales representative when considering using this product in special applications such as passenger mobile, medical, aerospace, nuclear, power or undersea relay equipment or system.
- Although this product was manufactured under conditions of strict quality control, install safety devices to prevent serious accidents when it is used in facilities where breakdowns of the product or other failures are likely to cause a serious accident.
- Do not use the inverter for a load other than the three-phase induction motor and the PM motor.
- Do not connect a PM motor in the induction motor control settings (initial settings). Do not use an induction motor in the PM motor control settings. It will cause a failure.
- When using an IPM motor (MM-EFS, MM-THE4), also refer to the precautions for use of the IPM motors (MM-EFS, MM-THE4).

### ◆ Operation

- When a magnetic contactor (MC) is installed on the input side, do not use the MC for frequent starting/stopping. Otherwise the inverter may be damaged.
- When a fault occurs in the inverter, the protective function is acticvated to stop the inverter output. However, the motor cannot be immediately stopped. For machinery and equipment that require an immediate stop, provide a mechanical stop/holding mechanism.
- Even after turning OFF the inverter/the converter unit, it takes time to discharge the capacitor. Before performing an inspection, wait 10 minutes or longer after the power supply turns OFF, then check the voltage using a tester, etc.
- When the emergency drive operation is performed, the operation is continued or the retry is repeated even when a fault occurs, which may damage or burn the inverter and motor. Before restarting the normal operation after using this function, make sure that the inverter and motor have no fault.

### ◆ Wiring

- Applying the power to the inverter output terminals (U, V, W) causes a damage to the inverter. Before power-on, thoroughly check the wiring and sequence to prevent incorrect wiring, etc.
- Terminals P/+, P1, N/-, and P3 are the terminals to connect dedicated options or DC power supply (in the DC feeding mode). Do not connect any device other than the dedicated options or DC power supply (in the DC feeding mode). Do not short-circuit between the frequency setting power supply terminal 10 and the common terminal 5, and between the terminals PC and SD.
- To prevent a malfunction due to noise, keep the signal cables 10cm or more away from the power cables. Also, separate the main circuit cables at the input side from the main circuit cables at the output side.
- After wiring, wire offcuts must not be left in the inverter/the converter unit. Wire offcuts can cause an alarm, failure or malfunction. Always keep the inverter/the converter unit clean. When drilling mounting holes in an enclosure etc., take caution not to allow chips and other foreign matter to enter the inverter/ the converter unit.
- Set the voltage/current input switch correctly. Incorrect setting may cause a fault, failure or malfunction.

### ◆ Power supply

- When the inverter is connected near a large-capacity power transformer (1000 kVA or more) or when a power factor correction capacitor is to be switched over, an excessive peak current may flow in the power input circuit, damaging the inverter. To prevent this, always install an optional AC reactor (FR-HAL).



- If surge voltage occurs in the power supply system, this surge energy may flow into an inverter, and the inverter may display the overvoltage protection (E. OV[]) and trip. To prevent this, install an optional AC reactor (FR-HAL).
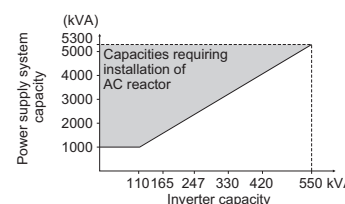
### ◆ Installation

- Install the inverter in a clean place with no floating oil mist, cotton fly, dust and dirt, etc. Alternatively, install the inverter inside the "sealed type" enclosure that prevents entry of suspended substances. For installation in the enclosure, decide the cooling method and the enclosure size to keep the surrounding air temperature of the inverter/the converter unit within the permissible range (for specifications, refer to **page 18**).
- Some parts of the inverter/the converter unit become extremely hot. Do not install the inverter/the converter unit to inflammable materials (wood etc.).
- Attach the inverter vertically.

### ◆ Setting

- Depending on the parameter setting, high-speed operation (up to 590 Hz) is available. Incorrect setting will lead to a dangerous situation. Set the upper limit by using the upper frequency limit setting.
- Setting the DC injection brake operation voltage and operating time larger than their initial values causes motor overheating (electronic thermal O/L relay trip).

## ● Precautions for use of IPM motor (MM-EFS, MM-THE4)

When using the IPM motor (MM-EFS, MM-THE4), the following precautions must be observed as well.

### ◆ ⚠ Safety instructions

- Do not use an IPM motor for an application where the motor is driven by the load and runs at a speed higher than the maximum motor speed.

### ◆ Combination of motor and inverter

- Use the same IPM motor capacity as the inverter capacity.
- Only one IPM motor can be connected to an inverter.
- An IPM motor cannot be driven by the commercial power supply.

### ◆ Installation

- While power is ON or for some time after power-OFF, do not touch the motor since the motor may be extremely hot. Touching these devices may cause a burn.
- The following table indicates the available installation orientations.

| | Simplified diagram | Frame number | 80M to 180L | 200L to 280MD |
|---|---|---|---|---|
| **Floor installation** *1 | Terminal direction A | | ⊙ | ⊙ |
| | Terminal direction B | | ○ | ○ |
| **Wall installation** *2 | Shaft going up | | Δ | × |
| | Shaft horizontal | | ⊙ | × |
| | Shaft going down | | ⊙ | × |
| **Ceiling installation** | Ceiling installation | | ⊙ | × |

⊙Standard models can be installed as they are.
○This can be used by an easy replacement.
ΔThis is supported by a dedicated product.
×Not available as installation strength is insufficient.

    *1    The floor installation condition is applicable to a slope of up to 30°. If the slope is steeper, apply the wall installation condition.
    *2    To install a horizontal motor to a wall, first attach a shelf that supports the motor legs.

### ◆ Wiring

- Applying the commercial power supply to input terminals (U,V, W) of a motor will burn the motor. The motor must be connected with the output terminals (U,V, W) of the inverter.
- An IPM motor is a motor with permanent magnets embedded inside. High voltage is generated at the motor terminals while the motor is running. Before wiring or inspection, confirm that the motor is stopped.
  In an application, such a as fan or blower, where the motor is driven by the load, a low-voltage manual contactor must be connected at the inverter's output side, and wiring and inspection must be performed while the contactor is open. Otherwise an electric shock may be caused. The inverter power must be turned ON before closing the contacts of the contactor at the output side.
- Match the input terminals (U, V, W) of the motor and the output terminals (U, V, W) of the inverter when connecting.

- Use the following length of wiring or shorter when connecting an IPM motor.

| Voltage class | Pr.72 setting (carrier frequency) | FR-F820-00077(1.5K) or lower FR-F840-00038(1.5K) or lower | FR-F820-00105(2.2K) or higher FR-F840-00052(2.2K) or higher |
|---|---|---|---|
| **200 V** | 0(2kHz) to 15(14kHz) | 100m | 100m |
| **400V** | 5(2kHz) or lower | 100m | 100m |
| | 6 to 9(6kHz) | 50m | 100m |
| | 10(10kHz) or higher | 50m | 50m |

Use one dedicated IPM motor for one inverter. Multiple IPM motors cannot be connected to an inverter.

### ◆ Operation

- About 0.1 s (magnetic pole detection time) takes to start a motor after inputting a start signal.
- An IPM motor is a motor with embedded permanent magnets. Regression voltage is generated when the motor coasts at an instantaneous power failure or other incidents.
  The inverter's DC bus voltage increases if the motor coasts fast in this condition. When using the automatic restart after instantaneous power failure function, it is recommended to also use the regeneration avoidance operation to make startups stable.
- The number of IPM motor poles differs by the capacity.
  Thus, the relation between the rotation speed and the frequency setting is:

$$\text{Rotation speed} = 120 \times \frac{\text{frequency setting value}}{\text{number of motor poles}}$$

| Speed [r/min] | Frequency setting value [Hz] | | |
|---|---|---|---|
| | MM-EFS | | MM-THE4 |
| | 0.75kW to 15kW | 18.5kW to 55kW | 75kW to 160kW |
| **300** | 15 | 20 | 15 |
| **600** | 30 | 40 | 30 |
| **900** | 45 | 60 | 45 |
| **1200** | 60 | 80 | 60 |
| **1500** | 75 | 100 | 75 |
| **1800** | 90 | 120 | 90 |
| **2250** | 112.5 | 150 | —*2 |
| **2400** | —*1 | —*1 | —*2 |
| **2700** | —*1 | —*1 | —*2 |

    *1    The maximum speed of MM-EFS is 2250r/min.
    *2    The maximum speed of MM-THE4 is 1800r/min.

### ◆ Connection with machine

#### ◆ Direct connection

- When installing, align the motor shaft center and the machine shaft. Insert a liner underneath the motor or the machine legs as required to make a perfect alignment.
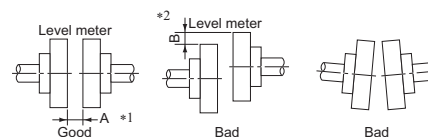
    *1    Set so that the A dimensions become the same dimension even when any position is measured by feeler gauge. (inequality in A width 3/100 mm or lower (2.5/100 mm or lower for MM-THE4))
    *2    Do not set parts with a vertical gap like B. (2.5/100 mm or lower for MM-THE4).

**NOTE**

    • When a fan or blower is directly connected to the motor shaft or to the machine, the machine side may become unbalanced. When the unbalanced degree becomes larger, the motor vibration becomes larger and may result in a damage of the bearing or other area. The balance quality with the machine should meet the class G2.5 or lower of JISB0905 (the Balance Quality Requirements of Rigid Rotors).

◆ **Connected by belt**
- When installing, place the motor shaft and the machine shaft in parallel, and mount them to a position where their pulley centers are aligned. Their pulley centers should also have a right angle to each shaft.
- An excessively stretched belt may damage the bearing and break the shafts. A loose belt may slip off and easily deteriorate. A flat belt should be rotated lightly when it is pulled by one hand. For details, refer to the Instruction Manual of the motor.

◆ **Connected by gear couplings**
- Place the motor and machine shafts in parallel, and engage the gear teeth properly.

### ◆ Permissible vibration of the motor
- Bearing is subjected to fretting while the motor is stopped. Suppress the vibration to about the half of the permissible value. Amplitude at each vibration condition is as shown right.
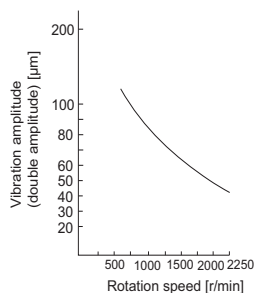


### ◆ Permissible load of the shaft

| MM-EFS□1M(4) | 7 | 15 | 22 | 37 | 55 | 75 | 11K |
|---|---|---|---|---|---|---|---|
| L [mm] *1 | 40 | 50 | 60 | | 80 | | 110 |
| Permissible radial load [N] *2 | 535 | 585 | 830 | 1070 | 1710 | | 2150 |
| Permissible thrust load [N] *2 | 470 | 500 | 695 | 900 | 1420 | | 1810 |

| MM-EFS□1M(4) | 15K | 18K | 22K | 30K | 37K | 45K | 55K |
|---|---|---|---|---|---|---|---|
| L [mm] *1 | 110 | | | | 140 | | |
| Permissible radial load [N] *2 | 2150 | 2940 | | 3230 | 4900 | | 5880 |
| Permissible thrust load [N] *2 | 1810 | 2350 | | 2740 | 2940 | | 2740 |

| MM-THE4 | Capacities | 75kW | 90kW | 110kW | 132kW | 160kW |
|---|---|---|---|---|---|---|
| | Frame number | 250MA | 250MD | 280MD | 280MD | 280MD |
| Permissible radial load [N] *2 *3 | | 3600 | 3600 | 4600 | 4600 | 4600 |
| Permissible thrust load [N] *2 | | 3900 | 3900 | 5000 | 5000 | 5000 |

*1 For the symbols used in the table, refer to the diagram at right.

*2 The permissible radial load and the permissible thrust load are the permissible values when they are applied individually.

*3 The loading point of the radial load is calculated at a tip of the shaft. Connecting by belt is available using an option. For the permissible radial load connected by belt, contact the nearest Mitsubishi FA center.
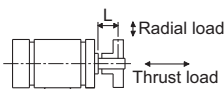
## ● Selection precautions

### ◆ Inverter capacity selection
- When operating a special motor or multiple motors in parallel by one inverter, select the inverter capacity so that 1.1 times of the total of the rated motor current becomes less than the rated output current of the inverter.
(Multiple PM motors cannot be connected to an inverter.)

### ◆ Starting torque of the motor
- The starting and acceleration characteristics of the motor driven by an inverter are restricted by the overload current rating of the inverter. In general, the torque characteristic has small value compared to when the motor is started by a commercial power supply. When a large starting torque is required, and torque boost adjustment, and Advanced magnetic flux vector control cannot generate the sufficient torque, increase both the motor and inverter capacities.

### ◆ Acceleration/deceleration time
- The motor acceleration/deceleration time is decided by the torque generated by the motor, load torque, and moment of inertia (J) of load.
- The required time may increase when the torque limit function or stall prevention function operates during acceleration/deceleration. In such a case, set the acceleration/decelerations time longer.
- To shorten the acceleration/deceleration time, increase the torque boost value (too large setting value may activate the stall prevention function, resulting in longer acceleration time at starting on the contrary). Alternatively, use Advanced magnetic flux vector control, or select the larger inverter and motor capacities. To shorten the deceleration time, use an addition brake unit (FR-BU2) to absorb braking energy, power regeneration common converter (FR-CV), or power supply regeneration unit (MT-RC), etc.

### ◆ Power transfer mechanisms (reduction gear, belt, chain, etc.)
- Caution is required for the low-speed continuous operation of the motor with an oil lubricated gear box, transmission, reduction gear, etc. in the power transfer mechanism. Such an operation may degrade the oil lubrication and cause seizing. On the other hand, the high-speed operation at more than 60 Hz may cause problems with the noise of the power transfer mechanism, life, or insufficient strength due to centrifugal force, etc. Fully take necessary precautions.

### ◆ Instructions for overload operation
- When performing frequent starts/stops by the inverter, rise/fall in the temperature of the transistor element of the inverter will repeat due to a repeated flow of large current, shortening the life from thermal fatigue. Since thermal fatigue is related to the amount of current, the life can be increased by reducing current at locked condition, starting current, etc. Reducing current may extend the service life but may also cause torque shortage, which leads to a start failure. Adding a margin to the current can eliminate such a condition. For an induction motor, use an inverter of a higher capacity. For an IPM motor, use an inverter and IPM motor of higher capacities.

Features

Application Example
PLC Function
FR Configurator2

Connection Examples

Standard Specs

Outline Dimensions

Terminal Connection Diagrams
Terminal Specs

Operation Panel

Operation Steps

Parameter List

Protective Functions

Options

LVS/Cables

Precautions

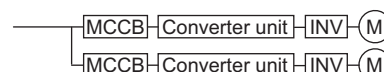Motors

Compatibility

Warranty
Inquiry

## ● Precautions on peripheral device selection

### ◆ Selection and installation of molded case circuit breaker

Install a molded case circuit breaker (MCCB) on the power receiving side to protect the wiring at the inverter/the converter unit input side. Select an MCCB according to the inverter power supply side power factor, which depends on the power supply voltage, output frequency and load. Refer to **page 98**. Especially for a completely electromagnetic MCCB, a slightly large capacity must be selected since its operation characteristic varies with harmonic currents. (Check the reference material of the applicable breaker.) As an earth leakage circuit breaker, use the Mitsubishi earth leakage circuit breaker designed for harmonics and surge suppression. (Refer to **page 97**.)
When installing a molded case circuit breaker on the inverter output side, contact the manufacturer of each product for selection.

### ◆ Handling of the input side magnetic contactor (MC)

For the operation using external terminals (using the terminal STF or STR), install the input-side magnetic contactor to prevent accidents due to automatic restart when the power is restored after power failures such as an instantaneous power failure, or for safety during maintenance works. Do not use this magnetic contactor for frequent starting/stopping of the inverter. (The switching life of the converter part is about 1 million times.) In the operation by parameter unit, the automatic restart after power restoration is not performed and the magnetic contactor cannot be used to start the motor. The input-side magnetic contactor can stop the motor. However, the regenerative brake of the inverter does not operate, and the motor coasts to a stop.

### ◆ Handling of the output side magnetic contactor (MC)

• Switch the MC between the inverter and motor only when both the inverter and motor are at a stop. When the magnetic contactor is turned ON while the inverter is operating, overcurrent protection of the inverter and such will activate. When an MC is provided to switch to a commercial power supply, for example, it is recommended to use the commercial power supply-inverter switchover function **Pr.135 to Pr.139**.
• Do not install a magnetic contactor at the inverter's output side when using a PM motor.

### ◆ Installation of thermal relay

In order to protect the motor from overheating, the inverter has an electronic thermal O/L relay. However, install an external thermal overcurrent relay (OCR) between the inverter and motors to operate several motors or a multi-pole motor with one inverter. In this case, set 0 A to the electronic thermal O/L relay setting of the inverter. For the external thermal overcurrent relay, determine the setting value in consideration of the current indicated on the motor's rating plate and the line-to-line leakage current. **(Refer to page 104.)**
Self cooling ability of a motor reduces in the low-speed operation. Installation of a thermal protector or a use of a motor with built-in thermistor is recommended.

### ◆ Output side measuring instrument

When the inverter-to-motor wiring length is long, especially for the 400 V class, small-capacity models, the meters and CTs may generate heat due to line-to-line leakage current. Therefore, choose the equipment which has enough allowance for the current rating.
When measuring and displaying the output voltage and output current of the inverter, use of the terminals AM and 5 output function of the inverter is recommended.

### ◆ Disuse of power factor improving capacitor (power factor correction capacitor)

The power factor improving capacitor and surge suppressor on the inverter output side may be overheated or damaged by the harmonic components of the inverter output. Also, since an excessive current flows in the inverter to activate overcurrent protection, do not provide a capacitor and surge suppressor. To improve the power factor, use a power factor improving DC reactor (on **page 83**).

### ◆ Connection between the converter unit and the inverter

• Perform wiring so that the commands sent from the converter unit are transmitted to the inverter without fail. Incorrect connection may damage the converter unit and the inverter.
• For the wiring length, refer to the table below.

| Total wiring length | Across the terminals P and P and the terminals N and N | 50 m or lower |
|---|---|---|
| | Other signal cables | 30 m or lower |

• For the cable gauge of the cable across the main circuit terminals P/+ and N/- (P and P, N and N), refer to **page 99**.

### ◆ Cable gauge and wiring distance

If the wiring distance is long between the inverter and motor, during the output of a low frequency in particular, use a large cable gauge for the main circuit cable to suppress the voltage drop to 2% or less. (The table on **page 98** indicates a selection example for the wiring length of 20 m.)
Especially for long-distance wiring or wiring with shielded cables, the inverter may be affected by a charging current caused by stray capacitances of the wiring, leading to an incorrect activation of the overcurrent protective function. Refer to the maximum wiring length shown in the following table.
When multiple motors are connected, use the total wiring length shown in the table or shorter (100 m or shorter under PM motor control. )

| Pr.72 setting (carrier frequency) | FR-F820-00046(0.75K), FR-F840-00023(0.75K) | FR-F820-00077(1.5K), FR-F840-00038(1.5K) | FR-F820-00105(2.2K) or higher, FR-F840-00052(2.2K) or higher |
|---|---|---|---|
| 2 (2kHz) or lower | 300m | 500m | 500m |
| 3 (3kHz) or higher | 200m | 300m | 500m |

When the operation panel is installed away from the inverter and when the parameter unit is connected, use a recommended connection cable.
For the remote operation using analog signals, keep the distance between the remote speed setter and the inverter to 30 m or less. Also, to prevent induction from other devices, keep the wiring away from the power circuits (main circuit and relay sequential circuit).
When the frequency setting is performed using the external potentiometer, not using the parameter unit, use a shielded or twisted cable as shown in the figure below. Connect the shield cable to the terminal 5, not to the earth (ground).
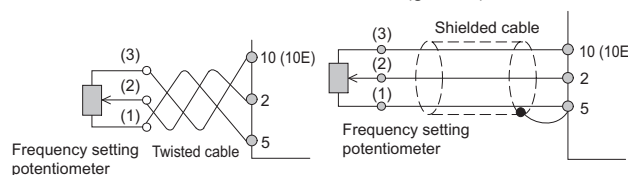


### ◆ Earth (ground)

When the inverter is set for the low acoustic noise operation, the leakage current increases compared to in the normal operation due to the high speed switching operation. Always earth (ground) the inverter, the converter unit, and the motor. Also, always use the earth (ground) terminal of the inverter/the converter unit for earthing (grounding). (Do not use a case or chassis.)

## ◆ Electromagnetic interference (EMI)

For the low acoustic noise operation with high carrier frequency, electromagnetic noise tends to increase. Take countermeasures by referring to the following examples. Depending on an installation condition, noise may affect the inverter also in the normal operation (initial status).

• Decrease the carrier frequency (**Pr.72**) setting to lower the EMI level.

• For countermeasures against the noise in AM radio broadcasting or malfunction of sensors, turn ON the EMC filter. (For the switching method, refer to the Instruction Manual.)

• For effective reduction of induction noise from the power cable of the inverter/the converter unit, secure the distance of 30 cm (at least 10 cm) from the power line and use a shielded twisted pair cable for the signal cable. Do not earth (ground) the shield, and connect the shield to a common terminal by itself.

EMI measure example
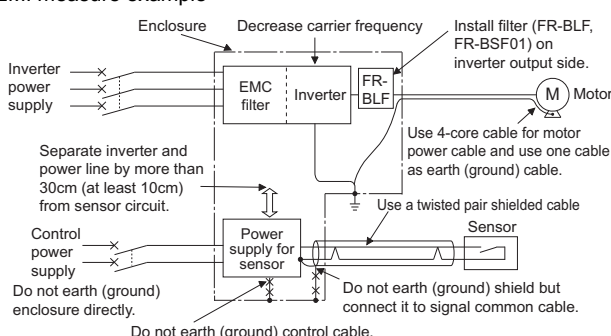


## ◆ leakage current

Capacitances exist between the inverter/the converter unit I/O cables and other cables or the earth, and within the motor, through which a leakage current flows. Since its value depends on the static capacitances, carrier frequency, etc., low acoustic noise operation at the increased carrier frequency of the inverter will increase the leakage current. Therefore, take the following countermeasures. Select the earth leakage circuit breaker according to its rated sensitivity current, independently of the carrier frequency setting.

### ◆ To-earth (ground) leakage currents

| Type | Influence and countermeasure |
|---|---|
| Influence and countermeasure | • Leakage currents may flow not only into the inverter/the converter unit's own line but also into the other lines through the earthing (grounding) cable, etc. These leakage currents may operate earth leakage circuit breakers and earth leakage relays unnecessarily. Countermeasure<br>• If the carrier frequency setting is high, decrease the **Pr.72 PWM frequency selection** setting. However, the motor noise increases. Selecting **Pr.240 Soft-PWM operation selection** makes the sound inoffensive.<br>• By using earth leakage circuit breakers designed for harmonic and surge suppression in the inverter's own line and other line, operation can be performed with the carrier frequency kept high (with low noise). |
| Transmission path |  |

### ◆ Line-to-line leakage current

| Type | Influence and countermeasure |
|---|---|
| Influence and countermeasure | • Line-to-line leakage current flows through the capacitance between the inverter/the converter unit output lines.<br>• Harmonic component of the leaked current may cause unnecessary operation of an external thermal relay. Long wiring length (50 m or longer) for the 400V class small capacity models (7.5 kW or lower) will increase the rate of leakage current against the rated motor current. In such a case, an unnecessary operation of the external thermal relay may be more liable to occur.<br>Countermeasure<br>• Use **Pr.9 Electronic thermal O/L relay**.<br>• If the carrier frequency setting is high, decrease the **Pr.72 PWM frequency selection** setting.<br>However, the motor noise increases. Selecting **Pr.240 Soft-PWM operation selection** makes the sound inoffensive.<br>To protect motor securely without being subject to the influence of the line-to-line leakage current, direct detection of the motor temperature using a temperature sensor is recommended. |
| Transmission path | <br>**Line-to-line leakage currents path** |

## ◆ Harmonic Suppression Guidelines

Harmonic currents flow from the inverter to a power receiving point via a power transformer. The Harmonic Suppression Guidelines was established to protect other consumers from these outgoing harmonic currents.

The three-phase 200 V input specifications 3.7 kW or lower were previously covered by the "Harmonic Suppression Guidelines for Household Appliances and General-purpose Products" and other models were covered by the "Harmonic Suppression Guidelines for Consumers Who Receive High Voltage or Special High Voltage". However, the general-purpose inverter has been excluded from the target products covered by the "Harmonic Suppression Guidelines for Household Appliances and General-purpose Products" in January 2004 and the "Harmonic Suppression Guideline for Household Appliances and General-purpose Products" was repealed on September 6, 2004.

All capacity and all models of general-purpose inverter used by specific consumers are now covered by the "Harmonic Suppression Guidelines for Consumers Who Receive High Voltage or Special High Voltage".

• "Harmonic Suppression Guidelines for Consumers Who Receive High Voltage or Special High Voltage"
This guideline sets the maximum values of outgoing harmonic currents generated from a high-voltage or specially high-voltage receiving consumer who will install, add or renew harmonic generating equipment. If any of the maximum values is exceeded, this guideline requires that consumer to take certain suppression measures.

The users who are not subjected to the above guidelines do not need follow the guidelines, but the users are recommended to connect a DC reactor and an AC reactor as usual.

Compliance with the "Harmonic Suppression Guidelines for Consumers Who Receive High Voltage or Special High Voltage"

| Input power | Target capacity | Countermeasure |
|---|---|---|
| Three-phase 200V | | Confirm the compliance with the "Harmonic Suppression Guidelines for Consumers Who Receive High Voltage or Special High Voltage" published in September 1994 by the Ministry of International Trade and Industry (the present Japanese Ministry of Economy, Trade and Industry). Take countermeasures if required. Use the following materials as reference to calculate the power supply harmonics.<br>Reference materials<br>• "Harmonic Suppression Measures of the General-purpose Inverter"<br>January 2004, Japan Electrical Manufacturers' Association |
| Three-phase 400V | All capacities | • "Calculation Method of Harmonic Current of the General-purpose Inverter Used by Specific Consumers"<br>JEM-TR201 (Revised in December 2003), Japan Electrical Manufacturers' Association |

For compliance to the "Harmonic Suppression Guideline of the General-purpose Inverter (Input Current of 20A or Less) for Consumers Other Than Specific Consumers" published by JEMA

| Input power | Target capacity | Measures |
|---|---|---|
| Three-phase 200V | 3.7 kW or lower | Connect the AC reactor or DC reactor recommended in the Catalogs and Instruction Manuals. Reference materials • "Harmonic suppression guideline of the general-purpose inverter (input current of 20A or less)" JEM-TR226 (Published in December 2003), Japan Electrical Manufacturers' Association |

## ◆ Calculation of outgoing harmonic current

Outgoing harmonic current = fundamental wave current (value converted from received power voltage) × operation ratio × harmonic content

• Operation ratio: Operation ratio = actual load factor × operation time ratio during 30 minutes
• Harmonic content: Found in Table.

• Harmonic contents (values when the fundamental wave current is 100%)

| Reactor | 5th | 7th | 11th | 13th | 17th | 19th | 23rd | 25th |
|---|---|---|---|---|---|---|---|---|
| Not used | 65 | 41 | 8.5 | 7.7 | 4.3 | 3.1 | 2.6 | 1.8 |
| Used (AC side) | 38 | 14.5 | 7.4 | 3.4 | 3.2 | 1.9 | 1.7 | 1.3 |
| Used (DC side)∗1 | 30 | 13 | 8.4 | 5.0 | 4.7 | 3.2 | 3.0 | 2.2 |
| Used (AC, DC sides) ∗1 | 28 | 9.1 | 7.2 | 4.1 | 3.2 | 2.4 | 1.6 | 1.4 |

∗1  The converter unit (FR-CC2) and the IP55 compatible model are equipped with a DC reactor on its DC side.

• Rated capacities and outgoing harmonic currents when driven by inverter

| Applied motor kW | Rated current (A) 200V | 400V | Fundamental wave current converted from 6.6 kV (mA) | Rated capacity (kVA) | Outgoing harmonic current converted from 6.6 kV (mA) (No reactor, 100% operation ratio) 5th | 7th | 11th | 13th | 17th | 19th | 23rd | 25th |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.4 | 1.61 | 0.81 | 49 | 0.57 | 31.85 | 20.09 | 4.165 | 3.773 | 2.107 | 1.519 | 1.274 | 0.882 |
| 0.75 | 2.74 | 1.37 | 83 | 0.97 | 53.95 | 34.03 | 7.055 | 6.391 | 3.569 | 2.573 | 2.158 | 1.494 |
| 1.5 | 5.50 | 2.75 | 167 | 1.95 | 108.6 | 68.47 | 14.20 | 12.86 | 7.181 | 5.177 | 4.342 | 3.006 |
| 2.2 | 7.93 | 3.96 | 240 | 2.81 | 156.0 | 98.40 | 20.40 | 18.48 | 10.32 | 7.440 | 6.240 | 4.320 |
| 3.7 | 13.0 | 6.50 | 394 | 4.61 | 257.1 | 161.5 | 33.49 | 30.34 | 16.94 | 12.21 | 10.24 | 7.092 |
| 5.5 | 19.1 | 9.55 | 579 | 6.77 | 376.1 | 237.4 | 49.22 | 44.58 | 24.90 | 17.95 | 15.05 | 10.42 |
| 7.5 | 25.6 | 12.8 | 776 | 9.07 | 504.4 | 318.2 | 65.96 | 59.75 | 33.37 | 24.06 | 20.18 | 13.97 |
| 11 | 36.9 | 18.5 | 1121 | 13.1 | 728.7 | 459.6 | 95.29 | 86.32 | 48.20 | 34.75 | 29.15 | 20.18 |
| 15 | 49.8 | 24.9 | 1509 | 17.6 | 980.9 | 618.7 | 128.3 | 116.2 | 64.89 | 46.78 | 39.24 | 27.16 |
| 18.5 | 61.4 | 30.7 | 1860 | 21.8 | 1209 | 762.6 | 158.1 | 143.2 | 79.98 | 57.66 | 48.36 | 33.48 |
| 22 | 73.1 | 36.6 | 2220 | 25.9 | 1443 | 910.2 | 188.7 | 170.9 | 95.46 | 68.82 | 57.72 | 39.96 |
| 30 | 98.0 | 49.0 | 2970 | 34.7 | 1931 | 1218 | 252.5 | 228.7 | 127.7 | 92.07 | 77.22 | 53.46 |
| 37 | 121 | 60.4 | 3660 | 42.8 | 2379 | 1501 | 311.1 | 281.8 | 157.4 | 113.5 | 95.16 | 65.88 |
| 45 | 147 | 73.5 | 4450 | 52.1 | 2893 | 1825 | 378.3 | 342.7 | 191.4 | 138.0 | 115.7 | 80.10 |
| 55 | 180 | 89.9 | 5450 | 63.7 | 3543 | 2235 | 463.3 | 419.7 | 234.4 | 169.0 | 141.7 | 98.10 |

| Applied motor kW | Rated current (A) 200V | 400V | Fundamental wave current converted from 6.6 kV (mA) | Rated capacity (kVA) | Outgoing harmonic current converted from 6.6 kV (mA) (With a DC reactor, 100% operation ratio) 5th | 7th | 11th | 13th | 17th | 19th | 23rd | 25th |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 75 | 245 | 123 | 7455 | 87.2 | 2237 | 969 | 626 | 373 | 350 | 239 | 224 | 164 |
| 90 | 293 | 147 | 8909 | 104 | 2673 | 1158 | 748 | 445 | 419 | 285 | 267 | 196 |
| 110 | 357 | 179 | 10848 | 127 | 3254 | 1410 | 911 | 542 | 510 | 347 | 325 | 239 |
| 132 | - | 216 | 13091 | 153 | 3927 | 1702 | 1100 | 655 | 615 | 419 | 393 | 288 |
| 160 | - | 258 | 15636 | 183 | 4691 | 2033 | 1313 | 782 | 735 | 500 | 469 | 344 |
| 220 | - | 355 | 21515 | 252 | 6455 | 2797 | 1807 | 1076 | 1011 | 688 | 645 | 473 |
| 250 | - | 403 | 24424 | 286 | 7327 | 3175 | 2052 | 1221 | 1148 | 782 | 733 | 537 |
| 280 | - | 450 | 27273 | 319 | 8182 | 3545 | 2291 | 1364 | 1282 | 873 | 818 | 600 |
| 315 | - | 506 | 30667 | 359 | 9200 | 3987 | 2576 | 1533 | 1441 | 981 | 920 | 675 |
| 355 | - | 571 | 34606 | 405 | 10382 | 4499 | 2907 | 1730 | 1627 | 1107 | 1038 | 761 |
| 400 | - | 643 | 38970 | 456 | 11691 | 5066 | 3274 | 1949 | 1832 | 1247 | 1169 | 857 |
| 450 | - | 723 | 43818 | 512 | 13146 | 5696 | 3681 | 2191 | 2060 | 1402 | 1315 | 964 |
| 500 | - | 804 | 48727 | 570 | 14618 | 6335 | 4093 | 2436 | 2290 | 1559 | 1462 | 1072 |
| 560 | - | 900 | 54545 | 638 | 16364 | 7091 | 4582 | 2727 | 2564 | 1746 | 1636 | 1200 |
| 630 | - | 1013 | 61394 | 718 | 18418 | 7981 | 5157 | 3070 | 2886 | 1965 | 1842 | 1351 |

# ✤ Compatible Motors

## ● List of applicable inverter models by rating (motor capacity → inverter model)

For the combinations within the thick boarders, always connect a DC reactor (FR-HEL), which is available as an option.

### ◆ 200 V class (model: FR-F820-[])

| Motor capacity (kW)[1] | DC reactor FR-HEL-[] | SLD (superlight load) | | | LD (light load) | | |
|---|---|---|---|---|---|---|---|
| | | Model | | Rated current (A) | Model | | Rated current (A) |
| 0.75 | 0.75K | 0.75K | 00046 | 4.6 | 0.75K | 00046 | 4.2 |
| 1.5 | 1.5K | 1.5K | 00077 | 7.7 | 1.5K | 00077 | 7 |
| 2.2 | 2.2K | 2.2K | 00105 | 10.5 | 2.2K | 00105 | 9.6 |
| 3.7 | 3.7K | 3.7K | 00167 | 16.7 | 3.7K | 00167 | 15.2 |
| 5.5 | 5.5K | 5.5K | 00250 | 25 | 5.5K | 00250 | 23 |
| 7.5 | 7.5K | 7.5K | 00340 | 34 | 7.5K | 00340 | 31 |
| 11 | 11K | 11K | 00490 | 49 | 11K | 00490 | 45 |
| 15 | 15K | 15K | 00630 | 63 | 15K | 00630 | 58 |
| 18.5 | 18.5K | 18.5K | 00770 | 77 | 18.5K | 00770 | 70.5 |
| 22 | 22K | 22K | 00930 | 93 | 22K | 00930 | 85 |
| 30 | 30K | 30K | 01250 | 125 | 30K | 01250 | 114 |
| 37 | 37K | 37K | 01540 | 154 | 37K | 01540 | 140 |
| 45 | 45K | 45K | 01870 | 187 | 45K | 01870 | 170 |
| 55 | 55K | 55K | 02330 | 233 | 55K | 02330 | 212 |
| 75 | 75K | 75K | 03160 | 316 | 75K | 03160 | 288 |
| 90 | 90K | 90K | 03800 | 380 | 90K | 03800 | 346 |
| 110 | 110K | | | | 110K | 04750 | 432 |
| 132 | 110K[2] | 110K | 04750 | 475 | - | - | - |

### ◆ 400 V class (model: FR-F840-[])

| Motor capacity (kW)[1] | DC reactor FR-HEL-[] | SLD (superlight load) | | | LD (light load) | | |
|---|---|---|---|---|---|---|---|
| | | Model | | Rated current (A) | Model | | Rated current (A) |
| 0.75 | H0.75K | 0.75K | 00023 | 2.3 | 0.75K | 00023 | 2.1 |
| 1.5 | H1.5K | 1.5K | 00038 | 3.8 | 1.5K | 00038 | 3.5 |
| 2.2 | H2.2K | 2.2K | 00052 | 5.2 | 2.2K | 00052 | 4.8 |
| 3.7 | H3.7K | 3.7K | 00083 | 8.3 | 3.7K | 00083 | 7.6 |
| 5.5 | H5.5K | 5.5K | 00126 | 12.6 | 5.5K | 00126 | 11.5 |
| 7.5 | H7.5K | 7.5K | 00170 | 17 | 7.5K | 00170 | 16 |
| 11 | H11K | 11K | 00250 | 25 | 11K | 00250 | 23 |
| 15 | H15K | 15K | 00310 | 31 | 15K | 00310 | 29 |
| 18.5 | H18.5K | 18.5K | 00380 | 38 | 18.5K | 00380 | 35 |
| 22 | H22K | 22K | 00470 | 47 | 22K | 00470 | 43 |
| 30 | H30K | 30K | 00620 | 62 | 30K | 00620 | 57 |
| 37 | H37K | 37K | 00770 | 77 | 37K | 00770 | 70 |
| 45 | H45K | 45K | 00930 | 93 | 45K | 00930 | 85 |
| 55 | H55K | 55K | 01160 | 116 | 55K | 01160 | 106 |
| 75 | H75K | 75K | 01800 | 180 | 75K | 01800 | 144 |
| 90 | H90K | | | | 90K | 02160 | 180 |
| 110 | H110K | 90K | 02160 | 216 | 110K | 02600 | 216 |
| 132 | H132K | 110K | 02600 | 260 | 132K | 03250 | 260 |
| 160 | H160K | 132K | 03250 | 325 | 160K | 03610 | 325 |
| 185 | H185K | 160K | 03610 | 361 | 185K | 04320 | 361 |
| 220 | H220K | 185K | 04320 | 432 | 220K | 04810 | 432 |
| 250 | H250K | 220K | 04810 | 481 | 250K | 05470 | 481 |
| 280 | H280K | 250K | 05470 | 547 | 280K | 06100 | 547 |
| 315 | H315K | 280K | 06100 | 610 | 315K | 06830 | 610 |
| 355 | H355K | 315K | 06830 | 683 | - | - | - |

### ◆ 400 V class (model: FR-F842-[])

| Motor capacity (kW)[1] | Converter unit FR-CC2-[] | SLD (superlight load) | | | LD (light load) | | |
|---|---|---|---|---|---|---|---|
| | | Model | | Rated current (A) | Model | | Rated current (A) |
| 355 | H355K | - | - | - | 355K | 07700 | 683 |
| 400 | H400K | 355K | 07700 | 770 | 400K | 08660 | 770 |
| 450 | H450K | 400K | 08660 | 866 | 450K | 09620 | 866 |
| 500 | H500K | 450K | 09620 | 962 | 500K | 10940 | 962 |
| 560 | H560K | 500K | 10940 | 1094 | 560K | 12120 | 1094 |
| 630 | H630K | 560K | 12120 | 1212 | - | - | - |

[1]   Indicates the maximum capacity applicable with the Mitsubishi 4-pole standard motor.
[2]   The FR-HEL-110K supports the 200 V class 132 kW motor.

### ◆ Overload current rating

| SLD | 110% 60 s, 120% 3 s (inverse-time characteristics) at surrounding air temperature 40°C |
|---|---|
| LD | 120% 60 s, 150% 3 s (inverse-time characteristics) at surrounding air temperature 50°C |

## ● High-performance energy-saving motor superline premium series SF-PR

We have released the superline premium series SF-PR models compatible with IE3 premium efficiency ahead of the three-phase motor energy efficiency regulations in Japan.
The SF-PR has achieved the efficiency class IE3 with the same dimensions as those of conventional models using our unique technology of the steel plate frame and new core materials.
It maintains interchangeability with our standard motor SF-JR and easy replacement becomes possible.
By adopting a high-efficiency motor, energy savings in plant facilities and reduction of electricity consumption are expected, as well as the effects of recovering the investment cost.

### ◆ One motor conforms to the power supply in Japan and the United States.

- The Japanese domestic three ratings conform to the Top Runner Standard of the "Act on the Rational Use of Energy (energy saving law)" to be applied on 1st April, 2015.
- The United States ratings conform to the Energy Independence and Security Act (EISA).

200/200/220V
50/ 60/ 60Hz

230V
60Hz
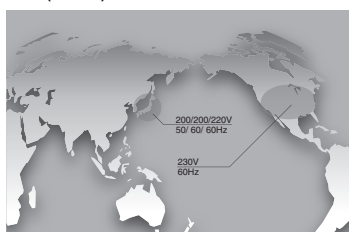
| 200 | 200 | 220 | 230 | V |
|-----|-----|-----|-----|---|
| 50 | 60 | 60 | 60 | Hz |

∗ For the 200 V class

**In Japan**      **In the United States**

### ◆ Interchangeable installation size

**Replaceable in the same space**

**SF-PR**

Excellent interchangeability with the same shaft diameter and the same shaft height!
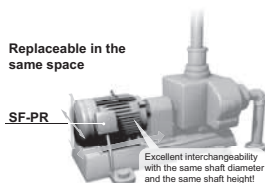
- Replacement can be smoothly performed because the installation size (frame number) is compatible with our standard motor SF-JR series.
- It is possible to use a power distribution control equipment (thermal relay and breaker), which is the same as a conventional one.

*1 For the frame number 180 LD or higher and some models of the 6P product, the total length or diametrical dimension is greatly different.
*2 The frame number is different from 1.5 kW6P (112M), 2.2 kW6P(132S) of the SF-HR models.
*3 When replacing the SF-JR to the SF-PR, it is required to consider upgrading the contactor to secure the same electric durability as using the SF-JR because the electric durability of the contactor may reduce by about 30%. Besides, when replacing the SF-JR to the SF-PR, the existing thermal relay may trip depending on the operating conditions (long starting time ). As a countermeasure, consider "Adjusting the heater set value of the thermal" or "Adopting the thermal with a saturated reactor ", etc.
*4 If the breaker NF400-SW manufactured by Mitsubishi Electric is used with the 55 kW motor (Y-Δ starting), change the breaker. (Change the rated current of the breaker NF400-SW from 300 A to 350 A.)

### ◆ Introduction effects of the superline premium series SF-PR

The SF-PR motor conforms to the Top Runner Standard (IE3 equivalent), which remarkably reduces its operation cost (electricity charges) and greatly contributes minimization of TCO (Total Cost Ownership).

- Trial calculation example of an annual saved sum of money ( at upgrading the motor from energy-efficiency class IE1 to IE3) Motor with 4-poles 200 V 50 Hz

Annual saved sum of money [yen]

Output [kW]

The annual saved sum of money is calculated in the following conditions.
· Annual operation time 4,380h（12h/day, 365days）
· Electricity rate 16yen/kWh
· Load ratio 75%
(When adjusted to be the same load.)
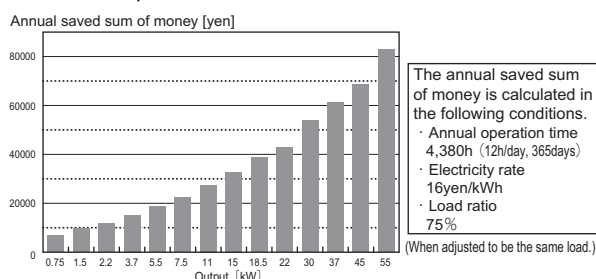
- Economic efficiency on an energy saving effect

The point of the energy saving effect

Cost benefits

Cost (Product + Electricity rate)

SF-JR
SF-PR (Premium Efficiency)

Number of years of use

Breakeven point

Recovery period for the amount of a price increase

Reduction in the electricity charges through the energy saving enables the investment cost to be recovered, and after that, the energy saving effect will bring some profit through power saving. The annual saved sum of money can be calculated according to the following formula. The longer operation time in an application, the more money can be saved.

<Calculation formula>

$$\text{Output (kW)} \times \left( \frac{100}{\text{Efficiency of current motor (\%)}} - \frac{100}{\text{Efficiency of SF-PR model (\%)}} \right) \times \text{Number of motors} \times \text{Number of hours of use (h/day)} \times \text{Number of days of operation (day/year)} \times \text{Electricity rate (yen/kWh)}$$

When replacing our standard motor SF-JR with the SF-PR on the ventilation fan in plant

＜Condition＞
Type : 11kW 4P 200V 50Hz 75% load
Units : 10units
Operation time : 12h/day 365day/year
Electricity rate: 16yen/kWh

Reduced cost of about 350,000 yen per year

Trial calculation results in replacing the SF-JR with the SF-PR with improved efficiency by 5% under the same conditions of the load factor, operation time, and electricity charges, etc.

## ◆ Lineup

● Model

S F - P R V O B

| Symbol | Structure |
|---|---|
| S | Superline series |

| Symbol | Enclosure type |
|---|---|
| F | Totally enclosed fan-cooled |

| Symbol | Series |
|---|---|
| PR | Premium series Steel plate frame |

| Symbol | Installation |
|---|---|
| None | Foot mounting type |
| V | Vertical type |
| F | Flange type |

| Symbol | Classification |
|---|---|
| None | Indoor type (IP44) |
| O | Outdoor type (IP44) |
| P | Dust-proof and waterproof type |

| Symbol | With or without brake |
|---|---|
| None | Without brake |
| B | With brake |

● Available models

| Model | | SF-PR | | | SF-PRV | | | SF-PRF | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Number of poles | | 2P | 4P | 6P | 2P | 4P | 6P | 2P | 4P | 6P |
| Output [kW] | 0.75 | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | 1.5 | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | 2.2 | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | 3.7 | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | 5.5 | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | 7.5 | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | 11 | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | 15 | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | 18.5 | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | 22 | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | 30 | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | 37 | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | 45 | ● | ● | ● | ● | ● | ● | ● | ● | — |
| | 55 | ● | ● | — | ● | ● | — | — | — | — |

## ● The SF-PR best matches Mitsubishi inverters

### ◆ This enables a constant-torque operation in the low-speed range. (expanding the constant-torque range)

- Combining with the standard motor SF-PR enables a constant-torque operation in the low-speed range.
- The SF-PR has superior performance to the SF-HRCA.
- The 400V class motors are insulation-enhanced motors as standard.

### ◆ Combination with Advanced magnetic flux vector control

- Enables a constant-torque operation down to 0.5 Hz in a super low-speed range.

SF-PR model  SF-HRCA model(High-efficiency constant-torque motor)
SF-HR model(High-efficiency motor)

Continuous operation torque (%) 60 Hz reference

100 92 60 57 50 45

Significantly expanded

220, 230V/440, 460V
200V/400V

Frequency (Hz)
0.5 3 6    60 65    100    120

### ◆ Combination with V/F control

- Enables a constant-torque operation down to 6 Hz in a low-speed range.

SF-PR model

Continuous operation torque (%) 60 Hz reference

100 92 60 57 50 45

Improved

SF-HRCA

220, 230V/440, 460V
200V/400V

Frequency (Hz)
6    20    60 65    100    120
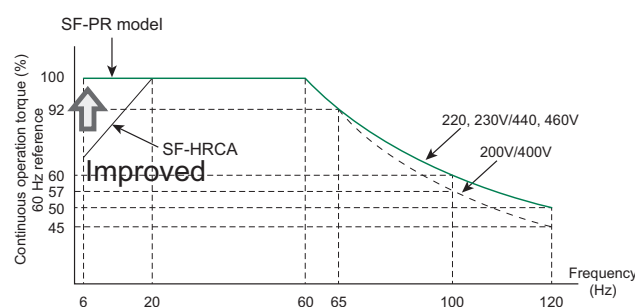
60 Hz torque reference indicates that the rated motor torque is 100% during 60 Hz operation.

### ◆ Motor torque

The following shows torque characteristics in combination with an inverter with the ND or HD rating. The overload capacity decreases for the LD or SLD rating. Observe the specified range of the inverter.

#### ◆ Maximum short-time torque

| Advanced magnetic flux vector control | V/F control |
|---|---|
| Output torque (%) 120, 60(50), 55(50), 0 — 220, 230V/440, 460V — 200V/400V — Output frequency (Hz) 0.5, 60, 120 | Output torque (%) 120, 60(50), 55(50), 0 — 220, 230V/440, 460V — 200V/400V — Output frequency (Hz) 6, 60, 120 |
| The values in parentheses are applicable to 1.5 kW and 2.2 kW. | The values in parentheses are applicable to 1.5 kW and 2.2 kW. |

#### ◆ Continuous torque

| Advanced magnetic flux vector control | V/F control |
|---|---|
| Output torque (%) 100, 50, 45, 0 — 220, 230V/440, 460V — 200V/400V — Output frequency (Hz) 0.5, 60, 120 | Output torque (%) 100, 50, 45, 0 — 220, 230V/440, 460V — 200V/400V — Output frequency (Hz) 6, 60, 120 |

## ● Application to standard motors

When the Mitsubishi standard squirrel-cage motor (SF-JR, 4-pole) and inverter of the same capacity are used, the torque characteristics are as shown below.

### ◆ Output characteristics



| 60 Hz torque reference | 50 Hz torque reference |
|---|---|
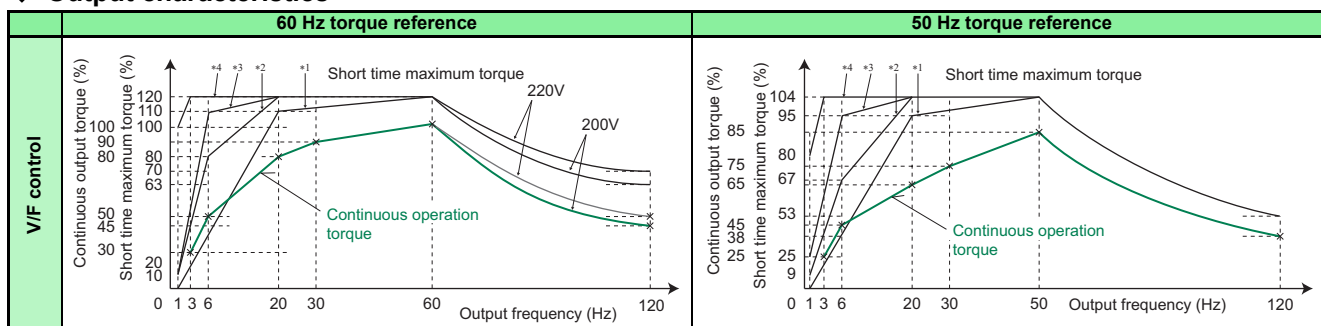
*1 Torque boost minimum (0%)
*2 Torque boost standard (initial value)
*3 Torque boost large
  10%: FR-F820-00046(0.75K), FR-F840-00023(0.75K)
  7%: FR-F820-00077(1.5K) to FR-F820-00167(3.7K), FR-F840-00038(1.5K) to FR-F840-00083(3.7K)
  6%: FR-F820-00250(5.5K), FR-F820-00340(7.5K), FR-F840-00126(5.5K), FR-F840-00170(7.5K)
  4%: FR-F820-00490(11K) or higher, FR-F840-00250(11K) or higher
*4 Torque boost adjustment (3.7 kW or lower)
*5 Under V/F control, all of SF-JR 2-pole, 4-pole, and 6-pole motors have the same torque characteristics.

- A 60 Hz torque reference indicates that the rated torque of the motor running at 60 Hz is 100%, and a 50 Hz torque reference indicates that the rated torque of the motor running at 50 Hz is 100%
- A general-purpose squirrel cage motor must be used at lower continuous operating torque in rated operation as shown in the chart since the cooling capability of the fan installed on the rotor reduces at a lower speed. (Instantaneous torque occurs.)
- The toque with 200 or 220 V at 60 Hz or 200 V at 50 Hz in the chart indicates a motor torque reference (base frequency set in **Pr.3** of the inverter) and is not the frequency of the power supply. In a 50 Hz power supply area, the 60 Hz setting can be set.
- As shown in the chart, the 60 Hz torque reference setting can bring out the 100% torque of the motor continuously, enabling more efficient use of the motor.
- When continuously operating a motor with the 50 Hz torque reference setting, set the load torque to 85% or lower.
- This chart shows the characteristic available when a constant-torque load is selected for load pattern selection **(Pr. 14)**.

### ◆ Motor loss and temperature rise

The motor operated by the inverter has a limit on the continuous operating torque since it is slightly higher in temperature rise than the one operated by a commercial power supply. At a low speed, reduce the output torque of the motor since the cooling effect decreases. When 100% torque is needed continuously at low speed, consider using a constant-torque motor.

### ◆ Torque characteristic

The motor operated by the inverter may be less in motor torque (especially starting torque) than the one driven by the commercial power supply. It is necessary to fully check the load torque characteristic of the machine.

### ◆ Vibration

The machine-installed motor operated by the inverter may be slightly greater in vibration than the one driven by the commercial power supply. The possible causes of vibration are as follows.

- Vibration due to imbalance of the rotator itself including the machine
- Resonance due to the natural oscillation of the mechanical system. Caution is required especially when the machine used at constant speed is operated at variable speed. The frequency jump function allows resonance points to be avoided during operation. (During acceleration/deceleration, the frequency within the setting range is passed through.) An effect is also produced if **Pr.72 PWM frequency selection** is changed. When a two-pole motor is operated at higher than 60 Hz, caution should be taken since such an operation may cause abnormal vibration.

### ◆ Application to constant-torque motors

Since a constant-torque motor is greater in current than the standard motor, the inverter capacity may be one rank higher. For a constant-torque motor, decrease **Pr.0 Torque boost** setting.
Recommended value 0.75kW... 6%, 1.5 to 3.7kW... 4%, 5.5 to 7.5kW...3%, 11 to 37kW...2%, 45 to 55kW...1.5%, 75k or higher...1%
When two or more motors are operated synchronously, torque imbalance is likely to occur as motor slip is smaller than that of the standard motor.

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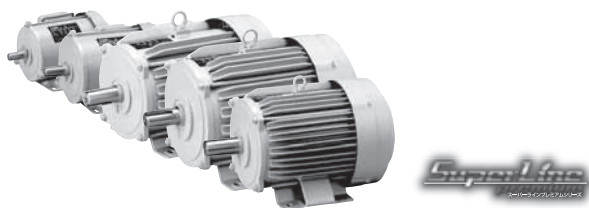Parameter List
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## ● Application to Premium high-efficiency IPM motor [MM-EFS (1500 r/min) series]

### ◆ Motor specification

| Moter model | 200V class MM-EFS[]1M | 7 | 15 | 22 | 37 | 55 | 75 | 11K | 15K | 18K | 22K | 30K | 37K | 45K | 55K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 400V class MM-EFS[]1M4 | | | | | | | | | | | | | | |
| Compatible inverter *3 | 200V class FR-F820-[] | 00046 (0.75K) | 00077 (1.5K) | 00105 (2.2K) | 00167 (3.7K) | 00250 (5.5K) | 00340 (7.5K) | 00490 (11K) | 00630 (15K) | 00770 (18.5K) | 00930 (22K) | 01250 (30K) | 01540 (37K) | 01870 (45K) | 02330 (55K) |
| | 400V class FR-F840-[] | 00023 (0.75K) | 00038 (1.5K) | 00052 (2.2K) | 00083 (3.7K) | 00126 (5.5K) | 00170 (7.5K) | 00250 (11K) | 00310 (15K) | 00380 (18.5K) | 00470 (22K) | 00620 (30K) | 00770 (37K) | 00930 (45K) | 01160 (55K) |
| Continuous characteristic *1 | Rated output (kW) | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 |
| | Rated torque (Num) | 4.77 | 9.55 | 14 | 23.6 | 35 | 47.7 | 70 | 95.5 | 118 | 140 | 191 | 236 | 286 | 350 |
| Rated speed (r/min) | | 1500 | | | | | | | | | | | | | |
| Maximum speed (r/min) | | 2250 | | | | | | | | | | | | | |
| Number of poles | | 6 | | | | | | | 8 | | | | | | |
| Maximum torque | | 120%  60 s | | | | | | | | | | | | | |
| Frame number | | 80M | 90L | 100L | 112M | 132S | 132M | 160M | 160L | 180M | | 180L | 200L | | 225S |
| Inertia moment J (×10⁻⁴ kg·m²) | | 20 | 40 | 55 | 110 | 275 | 280 | 760 | 770 | 1700 | 1700 | 1900 | 3400 | 3850 | 6500 |
| Rated current (A) | 200 V class | 3 | 6.0 | 8.2 | 13.4 | 20 | 27 | 40 | 54 | 66 | 79 | 110 | 128 | 157 | 194 |
| | 400 V class | 1.5 | 3.0 | 4.1 | 6.7 | 10 | 13.5 | 20 | 27 | 33 | 39.5 | 55 | 64 | 78.5 | 97 |
| Structure | | Totally-enclosed fan-cooled motor. With steel framed legs. (protective structure IP44 *2) | | | | | | | | | | | | | |
| Insulation class | | F class | | | | | | | | | | | | | |
| Vibration class | | V-15 | | | | | | | | | | | | | |
| Environment | Surrounding air temperature and humidity | -10°C to +40°C (non-freezing)·90%RH or less (non-condensing) | | | | | | | | | | | | | |
| | Storage temperature and humidity | -20°C to +70°C (non-freezing)·90%RH or less (non-condensing) | | | | | | | | | | | | | |
| | Atmosphere | Indoors (not under direct sunlight), and free from corrosive gas, flammable gas, oil mist, dust and dirt. | | | | | | | | | | | | | |
| | Altitude | Maximum 1,000 m above sea level | | | | | | | | | | | | | |
| | Vibration | 4.9 m/s² | | | | | | | | | | | | | |
| Mass (kg) | | 11 | 15 | 22 | 31 | 50 | 53 | 95 | 100 | 135 | | 155 | 215 | 230 | 285 |

*1 The above characteristics apply when the rated AC voltage is input from the inverter. (Refer to **page 18**.) Output and rated motor speed are not guaranteed when the power supply voltage drops.
*2 This excludes the part where the axis passes through.
*3 For the LD rating

### ◆ Motor torque characteristic

The following figure shows the torque characteristic of the premium high-efficiency IPM motor [MM-EFS (1500 r/min) series] when used with an inverter.
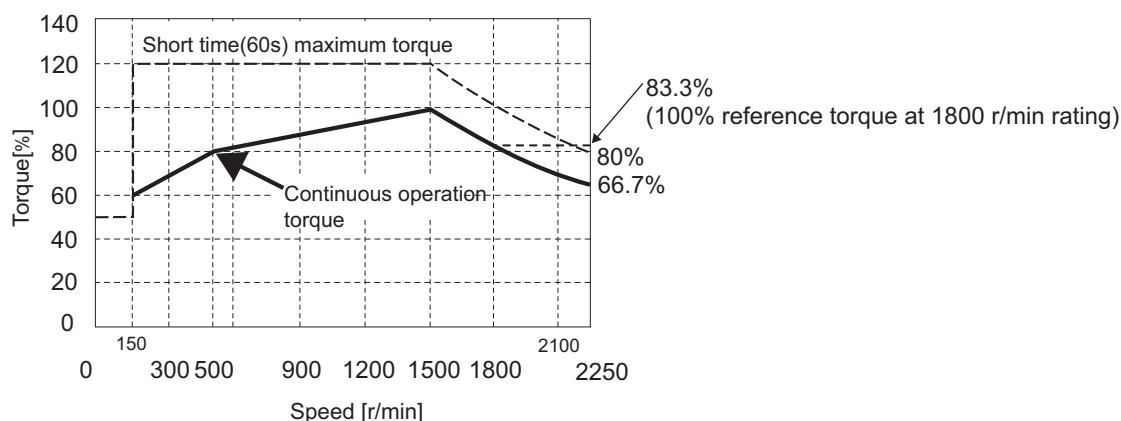


**NOTE**

• The motor can also be used for applications which require the rated speed of 1800 r/min.
• The torque characteristic is when the armature winding temperature is 20°C, and the input voltage to the inverter is  200 VAC or 400 VAC.
• Constant-speed operation cannot be performed for the speed of 150 r/min or less.

◆ **Motor outline dimensions**
- 30K or lower



Sliding distance
Cross section C-C
Frame leg viewed from underneath
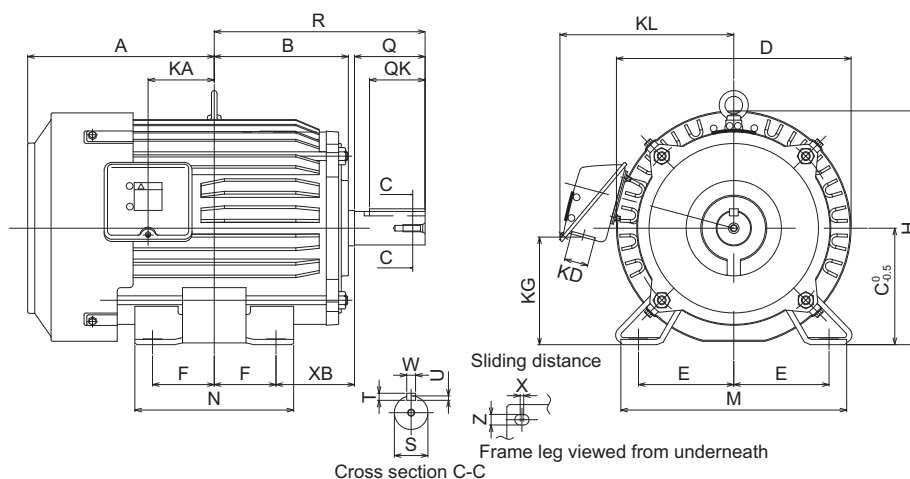
| Model | Output (kW) | Frame No. | Outline dimension (mm) | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A | B | C | D | E | F | H | KA | KD | KG | KL | M | N | XB | Q | QK | R | S | T | U | W | X | Z |
| 200V class MM-EFS[]1M  400V class MM-EFS[]1M4 | 7 / 0.75 | 80M | 122 | 95 | 80 | 161.6 | 62.5 | 50 | 164 | 39.5 | 27 | 63 | 145 | 160 | 125 | 50 | 40 | 32 | 140 | φ19j6 | 6 | 3.5 | 6 | 15 | 9 |
| | 15 / 1.5 | 90L | 143 | 110.5 | 90 | 183.6 | 70 | 62.5 | 182 | 53 | 27 | 76 | 158 | 175 | 150 | 56 | 50 | 40 | 168.5 | φ24j6 | 7 | 4 | 8 | 15 | 9 |
| | 22 / 2.2 | 100L | 173 | 128 | 100 | 207 | 80 | 70 | 203.5 | 65 | 27 | 88 | 169 | 200 | 180 | 63 | 60 | 45 | 193 | φ28j6 | 7 | 4 | 8 | 4 | 12 |
| | 37 / 3.7 | 112M | 181 | 135 | 112 | 228 | 95 | 70 | 226 | 69 | 27 | 103 | 180 | 230 | 180 | 70 | 60 | 45 | 200 | φ28j6 | 7 | 4 | 8 | 4 | 12 |
| | 55 / 5.5 | 132S | 211.5 | 152 | 132 | 266 | 108 | 70 | 265 | 75 | 27 | 120 | 197 | 256 | 180 | 89 | 80 | 63 | 239 | φ38k6 | 8 | 5 | 10 | 4 | 12 |
| | 75 / 7.5 | 132M | 230.5 | 171 | 132 | 266 | 108 | 89 | 265 | 94 | 27 | 120 | 197 | 256 | 218 | 89 | 80 | 63 | 258 | φ38k6 | 8 | 5 | 10 | 4 | 12 |
| | 11K / 11 | 160M | 252 | 198 | 160 | 318 | 127 | 105 | 316 | 105 | 56 | 142 | 266 | 310 | 254 | 108 | 110 | 90 | 323 | φ42k6 | 8 | 5 | 12 | 4 | 14.5 |
| | 15K / 15 | 160L | 274 | 220 | 160 | 318 | 127 | 127 | 316 | 127 | 56 | 142 | 266 | 310 | 298 | 108 | 110 | 90 | 345 | φ42k6 | 8 | 5 | 12 | 4 | 14.5 |
| | 18K / 18.5 | 180M | 292.5 | 225.5 | 180 | 363 | 139.5 | 120.5 | 359 | 127 | 56 | 168 | 289 | 335 | 285 | 121 | 110 | 90 | 351.5 | φ48k6 | 9 | 5.5 | 14 | 4 | 14.5 |
| | 22K / 22 | 180M | 292.5 | 225.5 | 180 | 363 | 139.5 | 120.5 | 359 | 127 | 56 | 168 | 289 | 335 | 285 | 121 | 110 | 90 | 351.5 | φ48k6 | 9 | 5.5 | 14 | 4 | 14.5 |
| | 30K / 30 | 180L | 311.5 | 242.5 | 180 | 363 | 139.5 | 139.5 | 359 | 146 | 56 | 168 | 289 | 335 | 323 | 121 | 110 | 90 | 370.5 | φ55m6 | 10 | 6 | 16 | 4 | 14.5 |

- 37K to 55K



M16 screw
Sliding distance
Cross section C-C
Frame leg viewed from underneath
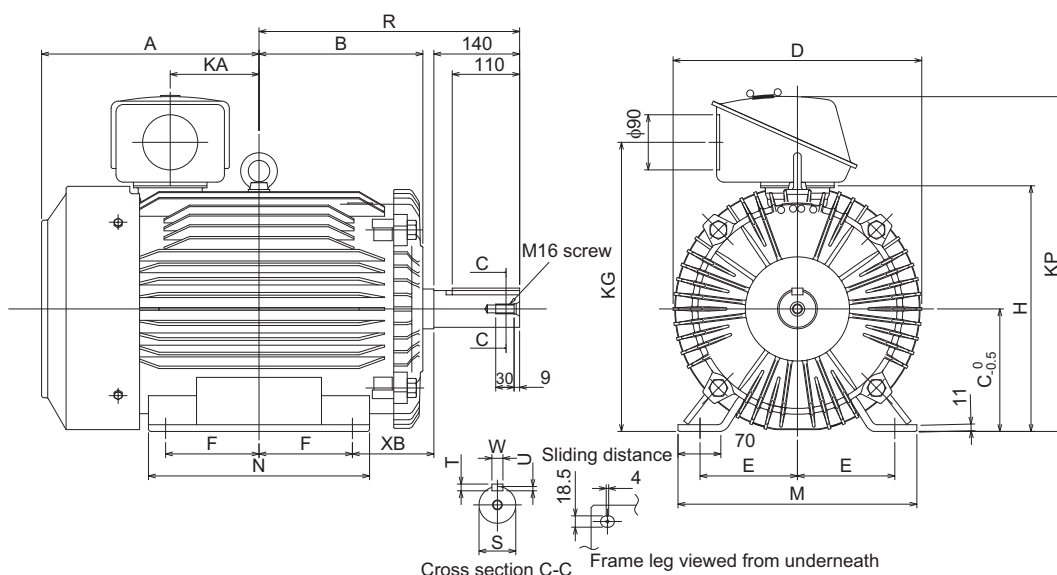
| Model | Output (kW) | Frame No. | Outline dimension (mm) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A | B | C | D | E | F | H | KA | KG | KP | M | N | XB | R | S | T | U | W |
| 200V class MM-EFS[]1M  400V class MM-EFS[]1M4 | 37K / 37 | 200L | 355 | 267.5 | 200 | 406 | 159 | 152.5 | 401 | 145 | 472 | 548 | 390 | 361 | 133 | 425.5 | φ60m6 | 11 | 7 | 18 |
| | 45K / 45 | 200L | 355 | 267.5 | 200 | 406 | 159 | 152.5 | 401 | 145 | 472 | 548 | 390 | 361 | 133 | 425.5 | φ60m6 | 11 | 7 | 18 |
| | 55K / 55 | 225S | 365 | 277 | 225 | 446 | 178 | 143 | 446 | 145 | 517 | 593 | 428 | 342 | 149 | 432 | φ65m6 | 11 | 7 | 18 |

⟨ **NOTE** ⟩
- The drawings shown above are sample outline dimension drawings. The outer appearance may differ depending on the frame number.

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Standard Specs

Outline Dimensions

Terminal Connection Diagrams Terminal Specs

Operation Panel

Operation Steps

Parameter List

Protective Functions

Options

LVS/Cables

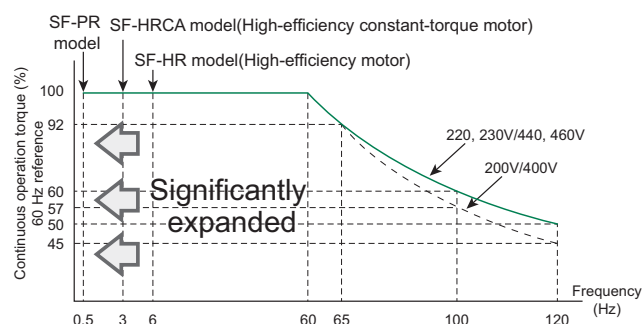Precautions

Motors

Compatibility

Warranty Inquiry

## ● Application to Premium high-efficiency IPM motor [MM-THE4 (1500 r/min) series]

### ◆ Motor specification

| Moter model | | MM-THE4 | | | | | |
|---|---|---|---|---|---|---|---|
| Voltage class | | 200V | 400V | | | | |
| Applicable inverter *2 | | FR-F820-[] | FR-F840-[] | | | | |
| | | 03160(75K) | 01800(75K) | 02160(90K) | 02600(110K) | 03250(132K) | 03610(160K) |
| Continuous characteristic *1 | Rated output (kW) | 75 | 75 | 90 | 110 | 132 | 160 |
| | Rated torque (N·m) | 477 | 477 | 573 | 700 | 840 | 1018 |
| Rated speed (r/min) | | 1500 | | | | | |
| Maximum speed (r/min) | | 1800 | | | | | |
| Number of poles | | 6 | | | | | |
| Maximum torque | | 120%  60 s | | | | | |
| Frame number | | 250MA | 250MA | 250MD | 280MD | | |
| Inertia moment J ($\times 10^{-4}$ kg·m$^2$) | | 6000 | 6000 | 10000 | 17500 | 20500 | 23250 |
| Rated current (A) | | 270 | 135 | 170 | 195 | 230 | 280 |
| Structure | | Totally-enclosed fan-cooled motor. With steel framed legs. (protective structure IP44) | | | | | |
| Insulation class | | F class | | | | | |
| Vibration class | | V-25 | | | | | |
| Environment | Surrounding air temperature and humidity | -10°C to +40°C (non-freezing) · 90%RH or less (non-condensing) | | | | | |
| | Storage temperature and humidity | -20°C to +70°C (non-freezing) · 90%RH or less (non-condensing) | | | | | |
| | Atmosphere | Indoors (not under direct sunlight), and free from corrosive gas, flammable gas, oil mist, dust and dirt. | | | | | |
| | Altitude | Maximum 1,000 m above sea level | | | | | |
| | Vibration | 4.9 m/s$^2$ | | | | | |
| Mass (kg) | | 470 | 470 | 610 | 780 | 810 | 860 |

∗1  Output and rated motor speed are not guaranteed when the power supply voltage drops.
∗2  For the LD rating

### ◆ Motor torque characteristic

The following figure shows the torque characteristic of the premium high-efficiency IPM motor [MM-THE4 (1500 r/min) series] when used with an inverter.



**NOTE**
- The motor can also be used for applications which require the rated speed of 1800 r/min.
- The torque characteristic is when the armature winding temperature is 20°C, and the input voltage to the inverter is 200 VAC or 400 VAC.
- Constant-speed operation cannot be performed for the speed of 150 r/min or less.

## ◆ Motor outline dimensions

- 75kW
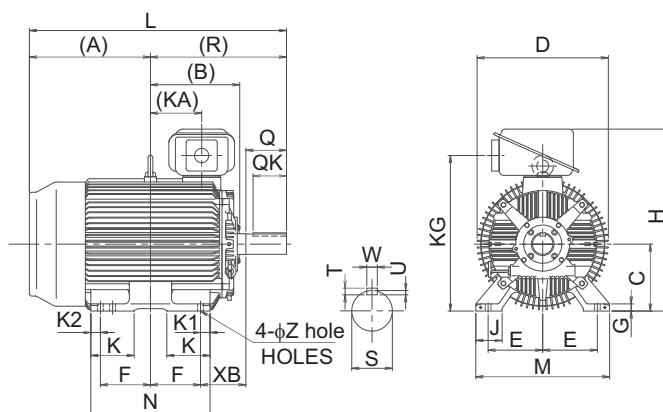


| Frame No. | Outline dimension (mm) | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | J | KA | KG | K | K1 | K2 | L | M | N | Z | XB | Q | QK | R | S | T | U | W |
| 250MA | 449.5 | 317 | 250 | 490 | 203 | 174.5 | 30 | 692 | 100 | 157.5 | 583 | 168 | 50 | 50 | 932 | 486 | 449 | 24 | 168 | 140 | 110 | 482.5 | 75m6 | 12 | 7.5 | 20 |

- 90kW
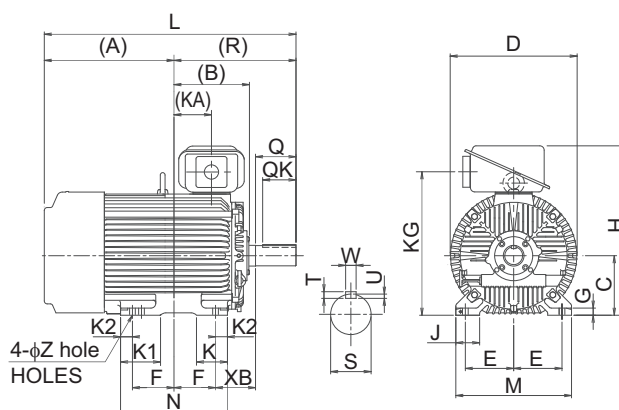


| Frame No. | Outline dimension (mm) | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | J | KA | KG | K | K1 | K2 | L | M | N | Z | XB | Q | QK | R | S | T | U | W |
| 250MD | 545.5 | 317 | 250 | 535 | 203 | 174.5 | 30 | 712 | 100 | 157.5 | 603 | 130 | 168 | 50 | 1028 | 486 | 449 | 24 | 168 | 140 | 110 | 482.5 | 75m6 | 12 | 7.5 | 20 |

- 110kW, 132kW, 160kW
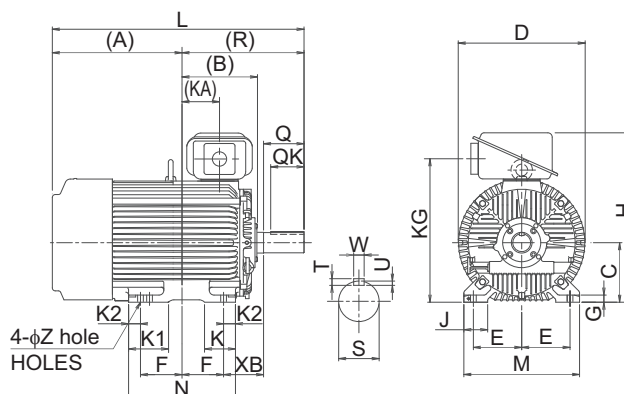


| Frame No. | Outline dimension (mm) | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | J | KA | KG | K | K1 | K2 | L | M | N | Z | XB | Q | QK | R | S | T | U | W |
| 280MD | 596.5 | 374 | 280 | 587 | 228.5 | 209.5 | 30 | 782 | 110 | 210.5 | 673 | 130 | 181 | 40 | 1166 | 560 | 499 | 24 | 190 | 170 | 140 | 569.5 | 85m6 | 14 | 9 | 22 |

**NOTE**
- The drawings shown above are sample outline dimension drawings. The outer appearance may differ depending on the frame number.
- For the 200 V class, models with capacities up to 75 kW are available.

## ● PM motor control, PM parameter initial setting

Performing the IPM parameter initialization makes the IPM motor MM-EFS, MM-THE4 ready for PM motor control.

PM motor control requires the following conditions.

- The motor capacity is equal to or one rank lower than the inverter capacity.
- Single-motor operation (one motor to one inverter) is preformed.
- The overall wiring length with the motor is 100 m or shorter. (Even with the IPM motor MM-EFS, MM-THE4, when the wiring length exceeds 30 m, perform offline auto tuning.)

### ◆ Setting procedure of PM motor control

#### ◆ Selecting the PM motor control by the IPM initialization mode

This inverter is set for an induction motor in the initial setting. Follow the following procedure to change the setting for the PM motor control.

**POINT**

- The parameters required to drive an MM-EFS, MM-THE4 IPM motor are automatically changed as a batch.
- To change to the PM motor control, perform the following steps before setting other parameters. If the PM motor control is selected after setting other parameters, some of those parameters will be initialized too. (Refer to "PM parameter initialization list" for the parameters that are initialized.)

### Operation

| 1. | Screen at power-ON |
| | The monitor display appears. |
| 2. | Changing the operation mode |
| | Press [PU EXT] to choose the PU operation mode. [PU] indicator is lit. |
| 3. | Parameter setting mode |
| | Press [MODE] to choose the parameter setting mode. [PRM] indicator is lit. |
| 4. | IPM parameter initialization |
| | Turn ⊙ until 𝟷 𝖯𝖬(IPM parameter initialization) appears. |
| 5. | Setting value display |
| | Press [SET] to read the present set value. "𝟢" (initial value) appears. |
| 6. | Changing the setting value |
| | Turn ⊙ to change the set value to " 𝟷𝟤 ", then press [SET]. |
| | " 𝟷𝟤 " and "𝟷 𝖯𝖬" flicker alternately. The setting is completed. |

| Setting value | Description |
| --- | --- |
| 0 | Parameter settings for an induction motor |
| 12 | Parameter settings for a premium high-efficiency IPM motor (rotations per minute) (MM-EFS, MM-THE4) |

**NOTE**

- Performing IPM parameter initialization in the parameter setting mode automatically changes the **Pr.998PM parameter initialization** setting.
- In the initial parameter setting, the capacity same as the inverter capacity is set in **Pr.80 Motor capacity**. To use a motor capacity that is one rank lower than the inverter capacity, set Motor capacity by selecting the mode on the operation panel.
- To set a speed or to display monitored items in frequency, set **Pr.998**. (Refer to Instruction Manual (Detailed).)

#### ◆ Selecting the PM sensorless vector control by Pr.998

- Setting **Pr.998 PM parameter initialization** as shown in the following table activates PM motor control.

| Pr.998 setting | Description | Operation on IPM parameter initialization |
| --- | --- | --- |
| 0 (initial value) | Parameter settings for an induction motor (frequency) | 𝟷 𝖯𝖬(IPM) → write "0" |
| 12 | Parameter settings for an IPM motor MM-EFS, MM-THE4 (rotations per minute) | 𝟷 𝖯𝖬(IPM) → write "12" |
| 112 | Parameter settings for an IPM motor MM-EFS, MM-THE4 (frequency) | - |
| 8009 | Parameter (rotations per minute) settings for an IPM motor other than MM-EFS, MM-THE4 (after tuning) | - |
| 8109 | Parameter (frequency) settings for an IPM motor other than MM-EFS, MM-THE4 (frequency) | - |
| 9009 | Parameter (rotations per minute) settings for an SPM motor (after tuning) | - |
| 9109 | Parameter (frequency) settings for an SPM motor (after tuning) | - |

**NOTE**

- The S-PM geared motor cannot be driven.

## ◆ PM parameter initialization list

- The parameter settings in the following table are changed to the settings required to perform PM motor control by selecting PM motor control with the IPM parameter initialization mode on the operation panel or with **Pr.998 PM parameter initialization**.
- Performing parameter clear or all parameter clear sets back the parameter settings to the settings required to drive an induction motor.

| Pr. | Name | Induction motor Pr.998 0 (initial value) FM | CA | PM motor (rotations per minute) 12 (MM-EFS, MM-THE4) | 8009 9009 (other than MM-EFS, MM-THE4) | PM motor (frequency) 112 (MM-EFS, MM-THE4) | 8109 9109 (other than MM-EFS, MM-THE4) | Setting increments 12, 8009, 9009 | 0, 112, 8109, 9109 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Maximum frequency | 120 Hz*1 / 60 Hz*2 | | Maximum motor rotations per minute | Maximum motor frequency*6 | Maximum motor frequency | Maximum motor frequency*6 | 1 r/min | 0.01 Hz |
| 4 | Multi-speed setting (high speed) | 60 Hz | 50 Hz | Rated motor rotations per minute | Pr.84 | Rated motor frequency | Pr.84 | 1 r/min | 0.01 Hz |
| 9 | Electronic thermal O/L relay | Rated inverter current | | Rated motor current (Refer to page 111, page 113.) | — | Rated motor current (Refer to page 111, page 113.) | — | 0.01 A*1 / 0.1 A*2 | |
| 13 | Starting frequency | 0.5 Hz | | Minimum rotations per minute | Pr.84 × 10% | Minimum frequency | Pr.84 × 10% | 1 r/min | 0.01 Hz |
| 15 | Jog frequency | 5 Hz | | Minimum rotations per minute | Pr.84 × 10% | Minimum frequency | Pr.84 × 10% | 1 r/min | 0.01 Hz |
| 18 | High speed maximum frequency | 120 Hz*1 / 60 Hz*2 | | Maximum motor rotations per minute | — | Maximum motor frequency | — | 1 r/min | 0.01 Hz |
| 20 | Acceleration/deceleration reference frequency | 60 Hz | 50 Hz | Rated motor rotations per minute | Pr.84 | Rated motor frequency | Pr.84 | 1 r/min | 0.01 Hz |
| 22 | Stall prevention operation level | 120% *5 | 110% *5 | Short-time motor torque | | | | 0.1% | |
| 37 | Speed display | 0 | | 0 | | | | 1 | |
| 55 | Frequency monitoring reference | 60 Hz | 50 Hz | Rated motor rotations per minute | Pr.84 | Rated motor frequency | Pr.84 | 1 r/min | 0.01 Hz |
| 56 | Current monitoring reference | Rated inverter current | | Rated motor current (Refer to page 111, page 113.) | Pr.859 | Rated motor current (Refer to page 111, page 113.) | Pr.859 | 0.01 A*1 / 0.1 A*2 | |
| 71 | Applied motor | 0 | | 210*3 | — | 210*3 | — | 1 | |
| 80 | Motor capacity | 9999 | | Inverter capacity*4 | — | Inverter capacity*4 | — | 0.01 kW*1 / 0.1 kW*2 | |
| 81 | Number of motor poles | 9999 | | Number of motor poles*4 | — | Number of motor poles*4 | — | 1 | |
| 84 | Rated motor frequency | 9999 | | Rated motor rotations per minute*4 | — | Rated motor frequency*4 | — | 1 r/min | 0.01 Hz |
| 125 (903) | Terminal 2 frequency setting gain frequency | 60 Hz | 50 Hz | Rated motor rotations per minute | Pr.84 | Rated motor frequency | Pr.84 | 1 r/min | 0.01 Hz |
| 126 (905) | Terminal 4 frequency setting gain frequency | 60 Hz | 50 Hz | Rated motor rotations per minute | Pr.84 | Rated motor frequency | Pr.84 | 1 r/min | 0.01 Hz |
| 144 | Speed setting switchover | 4 | | Number of motor poles + 100 | Pr.81 + 100 | Number of motor poles | Pr.81 | 1 | |
| 240 | Soft-PWM operation selection | 1 | | 0 | | | | 1 | |
| 263 | Subtraction starting frequency | 60 Hz | 50 Hz | Rated motor rotations per minute | Pr.84 | Rated motor frequency | Pr.84 | 1 r/min | 0.01 Hz |
| 266 | Power failure deceleration time switchover frequency | 60 Hz | 50 Hz | Rated motor rotations per minute | Pr.84 | Rated motor frequency | Pr.84 | 1 r/min | 0.01 Hz |
| 374 | Overspeed detection level | 9999 | | Overspeed detection level, rotations per minute | Maximum motor frequency + 10 Hz *6 | Overspeed detection level, frequency | Maximum motor frequency + 10 Hz *6 | 1 r/min | 0.01 Hz |
| 390 | % setting reference frequency | 60 Hz | 50 Hz | Rated motor rotations per minute | Pr.84 | Rated motor frequency | Pr.84 | 1 r/min | 0.01 Hz |
| 505 | Speed setting reference | 60 Hz | 50 Hz | Rated motor frequency | Pr.84 | Rated motor frequency | Pr.84 | 0.01 Hz | |

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| Pr. | Name | Setting | | | | | | Setting increments | |
|---|---|---|---|---|---|---|---|---|---|
| | | Induction motor | | PM motor (rotations per minute) | | PM motor (frequency) | | | |
| | | 0 (initial value) | | 12 (MM-EFS, MM-THE4) | 8009 9009 (other than MM-EFS, MM-THE4) | 112 (MM-EFS, MM-THE4) | 8109 9109 (other than MM-EFS, MM-THE4) | 12, 8009, 9009 | 0, 112, 8109, 9109 |
| | | Pr.998 | | | | | | | |
| | | FM | CA | | | | | | |
| 557 | Current average value monitor signal output reference current | Rated inverter current | | Rated motor current (Refer to **page 111**, **page 113**.) | **Pr.859** | Rated motor current (Refer to **page 111**, **page 113**.) | **Pr.859** | 0.01 A∗1 | |
| | | | | | | | | 0.1 A∗2 | |
| 870 | Speed detection hysteresis | 0 Hz | | Speed detection hysteresis rotations per minute | 0.5 Hz | Speed detection hysteresis frequency | 0.5 Hz | 1 r/min | 0.01 Hz |
| 885 | Regeneration avoidance compensation frequency limit value | 6 Hz | | Minimum rotations per minute | **Pr.84** × 10% | Minimum frequency | **Pr.84** × 10% | 1 r/min | 0.01 Hz |
| 893 | Energy saving monitor reference (motor capacity) | Rated inverter capacity | | Motor capacity **(Pr.80)** | | | | 0.01 kW∗1 | |
| | | | | | | | | 0.1 kW∗2 | |
| C14 (918) | Terminal 1 gain frequency (speed) | 60 Hz | 50 Hz | Rated motor rotations per minute | **Pr.84** | Rated motor frequency | **Pr.84** | 1 r/min | 0.01 Hz |

—: Not changed

∗1 Initial value for the FR-F820-02330(55K) or lower and FR-F840-01160(55K) or lower
∗2 Initial value for the FR-F820-03160(75K) or higher and FR-F840-01800(75K) or higher
∗3 Setting **Pr.71 Applied motor** = "213, 214, 8093, 8094, 9093, or 9094" does not change the **Pr.71** setting.
∗4 When a value other than "9999" is set, the set value is valid.
∗5 110% for SLD, 120% for LD
∗6 **Pr.702 Maximum motor frequency** is used as the maximum motor frequency. When **Pr.702** = "9999 (initial value)", **Pr.84 Rated motor frequency** is used as the maximum motor frequency.

**NOTE**
• If IPM parameter initialization is performed in rotations per minute (**Pr.998** = "3003, 8009, or 9009"), the parameters not listed in the table and the monitored items are also set and displayed in rotations per minute.

◆ **IPM motor specification list**

| | MM-EFS (15 kW or lower) | MM-EFS (18.5 kW to 55 kW) | MM-THE4 (75 kW to 160 kW) |
|---|---|---|---|
| Rated motor frequency (rotations per minute) | 75 Hz (1500 r/min) | 100 Hz (1500 r/min) | 75 Hz (1500 r/min) |
| Maximum motor frequency (rotations per minute) | 112.5 Hz (2250 r/min) | 150 Hz (2250 r/min) | 90 Hz (1800 r/min) |
| Number of motor poles | 6 | 8 | 6 |
| Short-time motor torque | 110% for SLD, 120% for LD | | |
| Minimum frequency (rotations per minute) | 7.5 Hz (150 r/min) | 10 Hz (150 r/min) | 7.5 Hz (150 r/min) |
| Speed detection hysteresis frequency (rotations per minute) | 0.5 Hz (10 r/min) | 0.5 Hz (8 r/min) | 0.5 Hz (10 r/min) |
| Overspeed detection level, frequency (rotations per minute) | 122.5 Hz (2450 r/min) | 160 Hz (2400 r/min) | 100 Hz (2000 r/min) |

## ◆ Specification comparison between the PM motor control and the induction motor control

| Item | | PM motor control | Induction motor control |
|---|---|---|---|
| **Applicable motor** | | Premium high-efficiency IPM motor MM-EFS, MM-THE4 series (the same capacity as the inverter capacity) | General-purpose motor SF-JR, SF-PR series, etc. |
| **Number of connectable motors** | | 1: 1 | Several motors can be driven under V/F control. |
| **Number of motor poles** | | MM-EFS 15 kW or lower: 6 poles<br>MM-THE4: 6 poles<br>MM-EFS 18.5 kW or higher: 8 poles | Normally 2, 4, or 6 poles. |
| **Rated motor frequency** | | MM-EFS 15 kW or lower: 75 Hz<br>MM-THE4: 75 Hz<br>MM-EFS 18.5 kW or higher: 100 Hz | Normally 50 Hz or 60 Hz |
| **Maximum output frequency** | | MM-EFS 15 kW or lower: 112.5 Hz (2250 r/min with 6P)<br>MM-EFS 18.5 kW or higher: 150 Hz (2250 r/min with 8P)<br>MM-THE4: 90 Hz (1800 r/min with 6P) | 590 Hz (17700 r/min with 4P) (Set the upper limit frequency (**Pr.0, Pr.18**) according to the motor and machine specifications.) |
| **Permissible load** | | 120% 60 s, 150% 3 s (inverse-time characteristics) (The % value is a ratio to the rated motor current.) | 120% 60 s, 150% 3 s (inverse-time characteristics) (The % value is a ratio to the rated inverter current.) |
| **Maximum starting torque** | | 50% | 120% (Advanced magnetic flux vector control) |
| **Frequency setting resolution** | **Analog input** | 0.018 Hz / 0 to 75 Hz (1500 r/min) / 0.025 Hz /0 to 100 Hz (1500 r/min) (0 to 10 V/12 bits) *1<br>0.036 Hz / 0 to 75 Hz (1500 r/min) / 0.05 Hz / 0 to 100 Hz (1500 r/min) (0 to 5 V/11 bits, 0 to 20 mA/11bits, 0 to ±10 V/12 bits) *1<br>0.072 Hz / 0 to 75 Hz (1500 r/min) / 0.1 Hz /0 to 100 Hz (1500 r/min) (0 to ±5 V/11 bits) *1 | 0.015 Hz / 0 to 60 Hz (1800 r/min with 4P) (0 to 10 V/12 bits)<br>0.03 Hz / 0 to 60 Hz (1800 r/min with 4P) (0 to 5 V/11 bits, 0 to 20 mA/11 bits, 0 to ±10 V/12 bits)<br>0.06 Hz / 0 to 60 Hz (1800 r/min with 4P) (0 to ±5 V/11 bits) |
| **Output signal** | **Pulse output for meter** | In the initial setting, 1 mA is output at the rated motor frequency from across terminals FM and SD. (SD is a common terminal.) The permissible frequency load current is 2 mA. Pulse specification: 1440 pulses/s at the rated motor frequency | In the initial setting, 1 mA is output at 60 Hz from across terminals FM and SD. (SD is a common terminal.) The permissible frequency load current is 2 mA. Pulse specification: 1440 pulses/s at 60 Hz |
| **Carrier frequency** | | 55K or lower: Four patterns of 2 kHz, 6 kHz, 10 kHz, and 14 kHz<br>75K or higher: Two patterns of 2 kHz and 6 kHz | 55K or lower: Selectable between 0.75 kHz to 14.5 kHz<br>75K or higher: 0.75 kHz to 6 kHz |
| **Automatic restart after instantaneous power failure** | | No startup waiting time. Using the regeneration avoidance function together is recommended. | Startup waiting time exists. |
| **Startup delay** | | Startup delay of about 0.1 s for initial tuning. | No startup delay. |
| **Driving by the commercial power supply** | | Not available Never connect an IPM motor to the commercial power supply. | Can be driven by the commercial power supply. |
| **Operation during motor coasting** | | While the motor is coasting, potential is generated across motor terminals. Before wiring, make sure that the motor is stopped. | While the motor is coasting, no potential is generated across motor terminals. |
| **Maximum motor wiring length** | | 100 m or shorter | Overall length: 500 m or shorter |

∗1 The values differ for the 15K and lower capacity premium high-efficiency IPM motor, which requires 6 poles to run at the rated motor speed (1500 r/min), or for 18K and higher, which requires 8 poles to run at the speed.

**NOTE**
- No slippage occurs with an IPM motor because of its characteristic.
- If an IPM motor, which took over a general-purpose motor, is driven at the same speed as for the general-purpose motor, the running speed of the IPM motor becomes faster by the amount of the general-purpose motor's slippage.
- Adjust the speed command to run the IPM motor at the same speed as the general-purpose motor, as required.

## ● Countermeasures against deterioration of the 400 V class motor insulation

When driving a 400 V class motor by the inverter, surge voltages attributable to the wiring constants may occur at the motor terminals, deteriorating the insulation of the motor. When the 400 V class motor is driven by the inverter, consider the following countermeasures:

### ◆ With induction motor

It is recommended to take one of the following countermeasures:

#### ◆ Rectifying the motor insulation and limiting the PWM carrier frequency according to the wiring length

For the 400 V class motor, use an insulation-enhanced motor.
(The Mitsubishi high-efficiency motor SF-HR, the Mitsubishi constant-torque motor SF-HRCA, and the Mitsubishi high-performance, energy-saving motor SF-PR are insulation-enhanced motors as standard.)
Specifically,
 • Order a "400 V class inverter-driven insulation-enhanced motor".
 • For the dedicated motor such as the constant-torque motor and low-vibration motor, use an "inverter-driven dedicated motor".
 • Set **Pr.72 PWM frequency selection** as indicated below according to the wiring length.

| Inverter | Wiring length 50 m or shorter | Wiring length 50 m to 100 m | Wiring length Longer than 100 m |
|---|---|---|---|
| Standard model | 15 (14.5 kHz) or lower | 9 (9 kHz) or lower | 4 (4 kHz) lower |
| Separated converter type | 6 (6 kHz) or lower | 6 (6 kHz) or lower | 4 (4 kHz) lower |

#### ◆ Suppressing the surge voltage on the inverter side
 • For FR-F840-01160(55K) or lower, connect a surge voltage suppression filter (FR-ASF-H/FR-BMF-H) at the output side of the inverter.
 • For FR-F840-01800(75K) or higher, connect a sine wave filter (MT-BSL/BSC) at the output side of the inverter.

### ◆ With PM motor

When the wiring length exceeds 50 m, set "9" (6 kHz) or less in **Pr.72 PWM frequency selection**.

**NOTE**

 • A surge voltage suppression filter (FR-ASF-H/FR-BMF-H) can be used under V/F control and Advanced magnetic flux vector control.
   A sine wave filter (MT-BSL/BSC) can be used under V/F control. Do not use the filters under unspecified controls.


## ● Application to special motors

### ◆ Motors with brake

Use the motor with brake having independent power supply for the brake, connect the brake power supply to the inverter primary side power and make the inverter output off using the output stop terminal (MRS) when the brake is applied (motor stop). Rattle may be heard according to the type of the brake in the low speed region but it is not a fault.

### ◆ Pole changing motor

As this motor differs in rated current from the standard motor, confirm the maximum current of the motor and select the inverter. Be sure to change the number of poles after the motor has stopped. If the number of poles is changed during rotation, the regenerative overvoltage protection circuit may be activated to cause an inverter alarm, coasting the motor to a stop.

### ◆ Geared motor

The continuous operating rotation range of this motor changes depending on the lubrication system and maker. Especially in the case of oil lubrication, continuous operation in the low-speed range only can cause gear seizure. For fast operation at higher than 60 Hz, please consult the motor maker.

### ◆ Synchronous motor other than PM motor

This motor is not suitable for applications of large load variation or impact, where out-of-sync is likely to occur. Please contact your sales representative when using this motor because its starting current and rated current are greater than those of the standard motor and will not rotate stably at low speed.

### ◆ Single phase motor

The single phase motor is not suitable for variable operation by the inverter.
For the capacitor starting system, the capacitor may be damaged due to harmonic current flowing to the capacitor. For the split-phase starting system and repulsion starting system, not only output torque is not generated at low speed but it will result in starting coil burnout due to failure of centrifugal force switch inside. Replace with a three-phase motor for use.

# � Compatibility

## ● Differences with the FR-F700(P) series

| Item | FR-F700(P) | FR-F800 |
|---|---|---|
| Control method | V/F control<br>Simple magnetic flux vector control<br>IPM motor control | V/F control<br>Advanced magnetic flux vector control<br>PM motor control (IPM motor/SPM motor) |
| Added functions | — | USB host function<br>Safety stop function<br>PLC function<br>etc. |
| Maximum output frequency V/F control | 400 Hz | 590 Hz |
| PID control | Turn the X14 signal ON to enable PID control. | The X14 signal does not need to be assigned. (PID control is available by the **Pr.128** setting.) |
| Automatic restart after instantaneous power failure | Turn the CS signal ON to enable restart.<br>**Pr.186 CS terminal function selection** initial value "6" | CS signal assignment not required. (Restart is enabled with the **Pr.57** setting only.)<br>**Pr.186 CS terminal function selection** initial value "9999" |
| PTC thermistor input | Input from the terminal AU (The function of the terminal AU is switched by a switch.) | Input from the terminal 2. (The function of the terminal 2 is switched by the **Pr.561** setting.) |
| USB connector | Not used | USB host: A connector<br>USB device: mini B connector |
| Main circuit terminal screw size | Terminals R/L1, S/L2, T/L3, U, V, W: Same for all capacities<br>Terminals P/+, N/-, P1: Same except for the 400 V class 01800(75K) (FR-F740(P)-01800(75K): M10, FR-F840-01800(75K): M8)<br>Screws for earthing (grounding): Same except for the 200 V class 03160(75K) (FR-F720(P)-03160(75K): M10, FR-F820-03160(75K): M8) | |
| Control circuit terminal block | Removable terminal block (screw type) | Removable terminal block (spring clamp type) |
| Terminal response level | The FR-F800's I/O terminals have better response level than the FR-F700(P)'s terminals. By setting **Pr.289 Inverter output terminal filter** and **Pr.699 Input terminal filter**, the terminal response level can be compatible with that of FR-F700(P). Set to approximately 5 to 8 ms and adjust the setting according to the system. | |
| PU | FR-DU07 (4-digit LED)<br>FR-PU07 | FR-DU08 (5-digit LED)<br>FR-LU08 (LCD)<br>FR-PU07 (Some functions, such as parameter copy, are unavailable.)<br>FR-DU07 is not supported. |
| Plug-in option | Dedicated plug-in options (not interchangeable) | |
| | One plug-in option can be mounted. | Up to three plug-in options can be mounted. |
| Installation size | Installation size is compatible for standard models. (Replacement between the same capacities does not require new mounting holes. However, for the 200 V class 03160(75K), the installation interchange attachment (FR-F8AT) is required.)<br>For separated converter types, installation size is not compatible. (New mounting holes are required.) | |
| Converter | Built-in for all capacities | An optional converter unit (FR-CC2) is required for separated converter types. |
| DC reactor | The 75K or higher comes with a DC reactor (FR-HEL). | For the FR-F820-03160(75K) or higher, the FR-F840-01800(75K) or higher, select a DC reactor suitable for the applicable motor capacity. (A DC reactor is not included.)<br>Separated converter types (converter unit FR-CC2) have a built-in DC reactor. |

### ◆ Installation precautions
- Removal procedure of the front cover is different. (Refer to the Instruction Manual.)
- Plug-in options of the FR-A700 series are not compatible.
- Operation panel (FR-DU07) cannot be used.

### ◆ Wiring precautions
- The spring clamp type terminal block has changed to the screw type. Use of blade terminals is recommended.

### ◆ Instructions for continuous use of the FR-PU07 (parameter unit)
- For the FR-F800 series, many functions (parameters) have been added. When setting these parameters, the parameter names and setting ranges are not displayed.
- Only the parameter with the numbers up to "999" can be read and set. The parameters with the numbers after "999" cannot be read or set.
- Many protective functions have been added for the FR-F800 series. These functions are available, but all faults are displayed as "Fault". When the faults history is checked, "ERR" appears. Added faults will not appear on the parameter unit. (However, MT1 to MT3 are displayed as MT.)
- Parameter copy/verification function are not available.

### ◆ Copying parameter settings
- The FR-F700(P) series' parameter settings can be easily copied to the FR-F800 series by using the setup software (FR Configurator2). (Not supported by the setup software FR-SW3-SETUP or older.)

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## ● Comparison with the FR-F700(P) series in functions

| Parameter/function | Main difference from F700(P) | | | Remarks |
|---|---|---|---|---|
| | Addition | Modification | Related parameter | |
| Maximum frequency | | ○ | Pr.1 etc. | Max. 590 Hz (Max. 400 Hz under other than V/F control) |
| Free thermal (electronic thermal O/L relay) | ○ | | Pr.600 to Pr.604, Pr.692 to Pr.696 | Thermal characteristics can be freely set. |
| PTC thermistor | ○ | | Pr.561 | The protection level can be set by parameters. |
| Strengthened excitation deceleration | ○ | | Pr.660 to Pr.662 | Loss of the motor is increased to reduce regenerative power. |
| 4 mA input check | ○ | | Pr.573, Pr.777, Pr.778 | Loss of 4 mA input is detected. |
| Input terminal filter | ○ | | Pr.699 | The terminal response can be adjusted. |
| Output terminal filter | ○ | | Pr.289 | The terminal response can be adjusted. |
| Remote output terminal (analog) | ○ | | Pr.655 to Pr.659 | Optional analog output |
| Parameter display by group | ○ | | Pr.Md | The parameters are displayed in the conventional numerical order in the initial state. |
| Traverse function | ○ | | Pr.592 to Pr.597 | |
| USB host (USB memory connection) | ○ | | Pr.1049 | Parameter read/copy, data logging, execution of the ladder in the USB (PLC function), etc. |
| Second PID control | ○ | | Pr.753 to Pr.758, Pr.1134, Pr.1135, Pr.1140, Pr.1141, Pr.1143 to Pr.1149 | |
| PID pre-charge function | ○ | | Pr.760 to Pr.769 | |
| Multi-pump function | ○ | | Pr.575 to Pr.591 | |
| PLC function | ○ | | Pr.414 to Pr.417, Pr.498, Pr.1150 to Pr.1199 | |
| Maintenance timer | | ○ | Pr.503, Pr.504, Pr.686 to Pr.689 | The number of maintenance timers is increased from 1 to 3. |
| Multiple rating selection | ○ | | Pr.570 | The rating can be selected from SLD, or LD. |
| 24 V external power supply input | ○ | | — | Operation is unavailable. (Communication and parameter setting are available.) |
| Cooling fan operation selection | | ○ | Pr.244 | Waiting time at stop can be changed. |
| Retry fanction | | ○ | Pr.65 to Pr.69 | The retry target faults are added. |
| Auto tuning | ○ | | Pr.96 | |
| Emergency drive | ○ | | Pr.514, Pr.515, Pr.523, Pr.524, Pr.1013 | |
| GOT automatic recognition | ○ | | — | The GOT2000 series is supported. |
| BACnet MS/TP | ○ | | Pr.726 to Pr.729 | |
| Load characteristics measurement/fault detection | ○ | | Pr.1480 to Pr.1492 | |
| PID gain tuning | ○ | | Pr.1211 to Pr.1219 | |
| Advanced magnetic flux vector control | ○ | | Pr.80, Pr.81, Pr.800 | |
| Advanced optimum excitation control | ○ | | Pr.60, Pr.80, Pr.81, Pr.800 | |
| Self power management | ○ | | Pr.30, Pr.137, Pr.248, Pr.254 | |

## ● Differences from the separated converter type (FR-F842)

| Item | FR-F842 | Remarks (FR-F840) |
|---|---|---|
| **Pr.30 Regenerative function selection** | Setting ranges "2, 10, 11, 102, 110, 111"<br>Initial value "10" | Setting ranges "0 to 2, 10, 11, 20, 21, 100, 101, 110, 111, 120, 121"<br>Initial value "0" |
| **Monitor function (Pr.52, Pr.54, Pr.158, Pr.774 to Pr.776, Pr.992, Pr.1027 to Pr.1034)** | Emergency drive status<br>Without (Unacceptable) | |
| **Input terminal function selection (Pr.178 to Pr.189)** | DC feeding operation permission (X70), DC feeding cancel (X71), Emergency drive execution command (X84)<br>Without (Unacceptable) | |
| **Pr.187 MRS terminal function selection** | Initial value "10" (X10) | Initial value "24" (MRS) |
| **Output terminal function assignment selection (Pr.190 to Pr.196, Pr.313 to Pr.322)** | Instantaneous power failure/undervoltage (IPF), Emergency drive in operation (Y65), Fault output during emergency drive (Y66), DC current feeding (Y85), Main circuit capacitor life (Y87), Inrush current limit circuit life (Y89)<br>Without (Unacceptable) | |
| **Pr.192 IPF terminal function selection** | Initial value "9999" (No function) | Initial value "2" (IPF) |
| **Inrush current limit circuit life display, Main circuit capacitor life display (Pr.256, Pr.258, Pr.259)** | Without the parameter | |
| **Emergency drive fanction (Pr.514, Pr.515, Pr.523, Pr.524, Pr.1013)** | Without the parameter | |
| **Pr.599 X10 terminal input selection** | Initial value "1" (N/C contact specifications) | Initial value "0" (N/O contact specifications) |
| **Pr.872 Input phase loss protection selection** | Without the parameter | |
| **Warning, protective functions** | Emergency drive in operation (ED), Instantaneous power failure (E.IPF), Undervoltage (E.UVT), Input phase loss (E.ILF), Inrush current limit circuit fault (E.IOH)<br>Not available | |

# ✿ Warranty

When using this product, make sure to understand the warranty described below.

1. Warranty period and coverage

   We will repair any failure or defect (hereinafter referred to as "failure") in our FA equipment (hereinafter referred to as the "Product") arisen during warranty period at no charge due to causes for which we are responsible through the distributor from which you purchased the Product or our service provider. However, we will charge the actual cost of dispatching our engineer for an on-site repair work on request by customer in Japan or overseas countries. We are not responsible for any on-site readjustment and/or trial run that may be required after a defective unit are repaired or replaced.

   [Term]
   The term of warranty for Product is twelve months after your purchase or delivery of the Product to a place designated by you or eighteen months from the date of manufacture whichever comes first ("Warranty Period"). Warranty period for repaired Product cannot exceed beyond the original warranty period before any repair work.

   [Limitations]
   (1) You are requested to conduct an initial failure diagnosis by yourself, as a general rule. It can also be carried out by us or our service company upon your request and the actual cost will be charged.
   However, it will not be charged if we are responsible for the cause of the failure.
   (2) This limited warranty applies only when the condition, method, environment, etc. of use are in compliance with the terms and conditions and instructions that are set forth in the instruction manual and user manual for the Product and the caution label affixed to the Product.
   (3) Even during the term of warranty, the repair cost will be charged on you in the following cases;
   1) a failure caused by your improper storing or handling, carelessness or negligence, etc., and a failure caused by your hardware or software problem
   2) a failure caused by any alteration, etc. to the Product made on your side without our approval
   3) a failure which may be regarded as avoidable, if your equipment in which the Product is incorporated is equipped with a safety device required by applicable laws and has any function or structure considered to be indispensable according to a common sense in the industry
   4) a failure which may be regarded as avoidable if consumable parts designated in the instruction manual, etc. are duly maintained and replaced
   5) any replacement of consumable parts (condenser, cooling fan, etc.)
   6) a failure caused by external factors such as inevitable accidents, including without limitation fire and abnormal fluctuation of voltage, and acts of God, including without limitation earthquake, lightning and natural disasters
   7) a failure caused by using the emergency drive function
   8) a failure generated by an unforeseeable cause with a scientific technology that was not available at the time of the shipment of the Product from our company
   9) any other failures which we are not responsible for or which you acknowledge we are not responsible for

2. Term of warranty after the stop of production
   (1) We may accept the repair at charge for another seven (7) years after the production of the product is discontinued. The announcement of the stop of production for each model can be seen in our Sales and Service, etc.
   (2) Please note that the Product (including its spare parts) cannot be ordered after its stop of production.

3. Service in overseas
   Our regional FA Center in overseas countries will accept the repair work of the Product; however, the terms and conditions of the repair work may differ depending on each FA Center. Please ask your local FA center for details.

4. Exclusion of responsibility for compensation against loss of opportunity, secondary loss, etc.
   Whether under or after the term of warranty, we assume no responsibility for any damages arisen from causes for which we are not responsible, any losses of opportunity and/or profit incurred by you due to a failure of the Product, any damages, secondary damages or compensation for accidents arisen under a specific circumstance that are foreseen or unforeseen by our company, any damages to products other than the Product, and also compensation for any replacement work, readjustment, start-up test run of local machines and the Product and any other operations conducted by you.

5. Change of Product specifications
   Specifications listed in our catalogs, manuals or technical documents may be changed without notice.

6. Application and use of the Product
   (1) For the use of our product, its applications should be those that may not result in a serious damage even if any failure or malfunction occurs in product, and a backup or fail-safe function should operate on an external system to product when any failure or malfunction occurs.

(2) Our product is designed and manufactured as a general purpose product for use at general industries.
Therefore, applications substantially influential on the public interest for such as atomic power plants and other power plants of electric power companies, and also which require a special quality assurance system, including applications for railway companies and government or public offices are not recommended, and we assume no responsibility for any failure caused by these applications when used.
In addition, applications which may be substantially influential to human lives or properties for such as airlines, medical treatments, railway service, incineration and fuel systems, man-operated material handling equipment, entertainment machines, safety machines, etc. are not recommended, and we assume no responsibility for any failure caused by these applications when used. We will review the acceptability of the abovementioned applications, if you agree not to require a specific quality for a specific application. Please contact us for consultation.

Features

Application Example
PLC Function
FR Configurator2

Connection
Examples

Standard
Specs

Outline
Dimensions

Terminal Connection
Diagrams
Terminal Specs

Operation Panel

Operation Steps

Parameter List

Protective
Functions

Options

LVS/Cables

Precautions

Motors

Compatibility

Warranty
Inquiry

# We visualize our customers' factories to solve problems and troubles.

## "Visualization" of production and energy achieves future factories that advance one step forward.

The integrated solution, e-F@ctory, is based on our consolidated know-how, which has been developed through our own experiences as a user of FA products. Our e-F@ctory provides total cost reduction ranging from development to production and maintenance to achieve optimized production. This solution makes it possible to save energy and to optimize production by "visualization" that links upstream information systems and production site information, thus solving various problems on production sites.

### Sharing information across production systems

**MES Interface**

Information sharing is easy and inexpensive because communication gateways, such as personal computers, are not necessary to connect factory equipment to the Manufacturing Execution System (MES).

### Optimizing production from a TCO* stand point

**iQ Platform**

Factory automation components such as controllers, human-machine interfaces, engineering environments, and networks are all seamlessly integrated to reduce TCO across different stages, from development to production and maintenance.

* TCO : Total Cost of Ownership

**iQ Platform**

CC-Link IE
Controller network

Numerical Controllers

### Visualization of energy consumption

**e&eco-F@ctory**

It is indispensable for today's factory to be energy conscious and efficient. The e-F@ctory solution enables management of specific energy consumption, which provides the visibility needed to improve productivity. Additionally, this solution takes the total life cycle into account, including factors such as "measurement and diagnosis", "countermeasures", and "operation and management". Backed by several successes and achievements, our know-how will support your energy saving efforts.

**iQ Platform**

## Network

CC-Link Family, the open field network of the world standard, and SSCNET III/H, the servo network for achieving high-speed processing and enhancement of instruction synchronization, flexibly expanding the connectivity among equipment and devices in the e-F@ctory environment.

## iQ Platform-compatible equipment

The inter-multi-CPU high-speed base unit provides slots for arbitrarily connecting programmable controllers, motion controllers, on-line CNCs, and robot controllers. Data communication speed among devices is enhanced, and their compatibility is extremely improved.

## iQ Platform-compatible engineering environments

Design information is integrated and shared at stages from system design to programming, tests and startup, and operation and maintenance. In addition, programming software programs for programmable controllers, motion controllers, on-line CNCs, robots, inverters, and GOTs, which are separately provided in a conventional environment, can be integrated.

# e-F@ctory

Products for achieving e-F@ctory

**ERP**
Operation and planning system

**MES**
Manufacturing execution system

**Information system**

**Ethernet**
Information network

**"Visualization" by information linkage**

Diagnosis unit with MES Interface (MELQIC)

HMI with MES Interface

Programmable Controllers with MES Interface

EcoServer III

**MES linkage function**

**Production site**

Robots | Safety Controllers | Motion Controllers | Programmable Controllers

Electrical-Discharge Machines | Laser Processing Machines

**CC-Link**
**CC-Link IE**
Field network

Field network
**B/NET**

**Safety field network**
CC-Link Safety

Safety remote I/O

**Field network**
CC-Link
CC-Link IE

Energy measurement unit | MDU breaker | Electronic multi-indicating instrument

**Servo-network**
SSCNET III/H
SERVO SYSTEM CONTROLLER NETWORK

AC Servo

Programmable Controllers | Geared motor | Robots

CC-Link-AnyWire Bitty Bridge

**Reduced wiring network**
CC-Link /LT

Remote I/O

**Sensor network**
Anywire

Foolproof terminal | Mapping sensor terminal

Inverter

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# [ Related Factory Automation Products ]

## PLC | MELSEC iQ-R Series

Revolutionary, next generation controllers building a new era in automation

◎High-speed, high-accuracy multiple CPU control system based on the iQ Platform

◎New high-speed system bus and inter-module sync realizes improved productivity and reduced TCO*

◎Reducing development costs through intuitive engineering (GX Works3)

◎Robust security features (such as security key authentication, IP filter)

Product Specifications

| | |
|---|---|
| Program capacity | 40K steps to 1200K steps |
| LD instruction speed | 0.98 ns |
| Available modules | I/O, analog, high-speed counter, positioning, simple motion, network module |
| Control system architecture | Rack-mounted modular based system |
| Supported networks | Ethernet, CC-Link IE Control Network, CC-Link IE Field Network, CC-Link, RS-232, RS-422/485 |

*Total Cost of Ownership

## Programmable Controller | MELSEC-L Series

"Light & Flexible" condensing various functions easily and flexibly.

◎CPU equipped as a standard with various functions including counter, positioning and CC-Link.

◎The base-less structure with high degree of freedom saves space in the control panel.

◎Easily confirm the system status and change the settings with the display unit.

◎Ten models are available in program capacities from 20 k steps to 260 k steps.

Product specifications

| | |
|---|---|
| Program capacity | 20 k steps/60 k steps/260 k steps |
| Number of input/output points [X/Y] | 1024 points/4096 points |
| Number of input/output device points [X/Y] | 8192 points |
| Basic instruction processing speed (LD instruction) | 60 ns/ 40 ns/ 9.5 ns |
| External connection interface | USB, Ethernet, RS-232, SD memory card, CC-Link (L26CPU-BT/PBT) |
| Function modules | I/O, analog, high-speed counter, positioning, simple motion, temperature control, network module |
| Unit expansion style | Base-less structure |
| Network | Ethernet, CC-Link IE Field network, CC-Link, CC-Link/LT, SSCNETIII(/H), RS-232, RS-422 |

## Programmable Controller | MELSEC-F Series

All-in-One Micro Programmable Controller equipped with all necessary functions in a compact body

◎Supporting small-scale control from 10 points to 384 points (using CC-Link) with an outstanding cost performance.

◎Wide range of options available for additional functions required by your system.

◎Easy to use and highly reliable. More than 12 million units have shipped worldwide. (April 2013)

◎Small-scale control is available in various networks such as CC-Link, Ethernet, and MODBUS.

Product specifications

| | |
|---|---|
| Program capacity | 16k steps (FX3S) to 64 k steps (FX3U/FX3UC) |
| Number of input/output points | 10 points (FX3S) to 384 points (FX3U/FX3UC with CC-Link) |
| Basic instruction processing speed | 0.21μs (FX3S) to 65 ns (FX3U/FX3UC) |
| External connection interface | RS-422, USB (FX3S/FX3G/FX3GC/FX3GE only), Ethernet (FX3GE only), CC-Link/LT (FX3UC-32MT-LT(-2) only) |
| Built-in functions | I/O, high-speed counter input, positioning pulse output, analog (FX3GE only) |
| Extended functions | I/O, analog, temperature control, high-speed counter, positioning, network |
| Unit expansion style | Backplane-less design |
| Network | Ethernet, CC-Link, CC-Link/LT, SSCNETIII, CANopen, J1939, RS-232C, RS-422, RS-485, MODBUS |

| HMI | Graphic Operation Terminal GOT2000 Series GT27 Model |

### To the top of HMIs with further user-friendly, satisfactory standard features.

◎Comfortable screen operation even if high-load processing (e.g. logging, device data transfer) is running. (Monitoring performance is twice faster than GT16)

◎Actual usable space without using a SD card is expanded to 128MB for more flexible screen design.

◎Multi-touch features, two-point press, and scroll operations for more user-friendliness.

◎Outline font and PNG images for clear, beautiful screen display.

Product Specifications

| | |
|---|---|
| Screen size | 15", 12.1", 10.4", 8.4" |
| Resolution | XGA, SVGA, VGA |
| Intensity adjustment | 32-step adjustment |
| Touch panel type | Analog resistive film |
| Built-in interface | RS-232, RS-422/485, Ethernet, USB, SD card |
| Applicable software | GT Works3 |
| Input power supply voltage | 100 to 240VAC (+10%, −15%), 24VDC (+25%, −20%) |

| AC Servo | Mitsubishi General-Purpose AC Servo MELSERVO-J4 Series |

### Industry-leading level of high performance servo

◎Industry-leading level of basic performance: Speed frequency response (2.5kHz), 4,000,000 (4,194,304p/rev) encoder

◎Advanced one-touch tuning function achieves the one-touch adjustment of advanced vibration suppression control II, etc.

◎Equipped with large capacity drive recorder and machine diagnosis function for easy maintenance.

◎2-axis and 3-axis servo amplifiers are available for energy-conservative, space-saving, and low-cost machines.

Product Specifications

| | |
|---|---|
| Power supply specifications | 1-phase/3-phase 200V AC, 1-phase 100V AC, 3-phase 400V AC |
| Command interface | SSCNET Ⅲ/H, SSCNET Ⅲ (compatible in J3 compatibility mode), CC-Link IE Field Network interface with Motion, pulse train, analog |
| Control mode | Position/Speed/Torque/Fully closed loop |
| Speed frequency response | 2.5kHz |
| Tuning function | Advanced one-touch tuning, advanced vibration suppression control II, robust filter, etc. |
| Safety function | STO, SS1 SS2, SOS, SLS, SBC, SSM (compatible when combined with motion controller) |
| Compatible servo motor | Rotary servo motor (rated output: 0.05 to 22kW), linear servo motor (continuous thrust 50 to 3000N), direct drive motor (rated torque: 2 to 240N·m) |

| AC Servo | Mitsubishi General-Purpose AC Servo MELSERVO-JE Series |

### High performance and easy to use servo system for all machines

◎Easy To Use: The advanced one-touch tuning function enables servo adjustment with one-touch ease without a personal computer.

◎High Performance: Class top-level basic performance including speed frequency response of 2.0kHz.

◎Global Standard: Digital input/output is compatible with both sink and source type connections as a standard.

Product specifications

| | |
|---|---|
| Power supply specifications | 1-phase/3-phase 200V AC |
| Command interface | Pulse train, analog |
| Control mode | Position/speed/torque |
| Speed frequency response | 2.0kHz |
| Tuning function | Advanced one-touch tuning, advanced vibration control II, robust filter, etc. |
| Compatible servo motor | Rotary servo motor (rated output: 0.1 to 3kW) |

# [ Related Factory Automation Products ]

| Inverters | FREQROL-F700PJ Series |

### Inverters for small fans and pumps.

✳ Can operate both general-purpose and IPM motors. Switching from general-purpose to IPM only by one setting.

✳ Models with a filter pack are available. These models do not require wiring for options.

✳ Any model provided with a filter pack can conform to Standard Specifications for Public Works Construction (2013 Edition) supervised by MLIT of Japan.

✳ Provided with functions (PID control, optimum excitation control, regeneration avoidance and restart during momentary power interruption) suitable for fans and pumps.

Product specifications

| | |
|---|---|
| Inverter capacity | 200-V class/400-V class: 0.4kW to 15kW |
| Control method | V/F, optimum excitation, general-purpose magnetic flux vector, IPM motor control |
| Output frequency range | General-purpose motor control: 0.2 to 400Hz<br>IPM motor control: 0 to 135Hz |
| Regenerative braking torque | General-purpose motor control: 15%<br>IPM motor control: 5% (10% for models of 1.5kW or less) |
| Starting torque | General-purpose motor control (in case of general-purpose magnetic flux vector control or slip correction setting): 120% (at 1 Hz)<br>IPM motor control: 50% |

| Three-Phase Motor | High Performance Energy-Saving Motor　Super Line Premium Series　SF-PR |

### Premium Efficiency & Compatible.  New Launch of Super Line Premium Series  SF-PR Model

◎Compared to general-purpose motor SF-JR model, generated loss is reduced by 37% on average, and it is compatible with highly efficient premium IE3.

◎Easy replacement is achieved as mounting dimension (frame number) is compatible with general-purpose motor SF-JR model.

◎One motor can accommodate different power sources of Japan and the U.S. Three ratings in Japan meet the Top Runner standards, while it corresponds to EISA in the U.S.

◎Can be driven by inverters as standard. Advanced magnetic-flux vector control by our FR-A800/700 achieves steady torque drive up to 0.5Hz.

Product Specifications

| | |
|---|---|
| Number of poles | 2-poles, 4-poles, 6-poles |
| Voltage・Frequency | 200/200/220/230V 50/60/60/60Hz EISA 230V 60Hz or 400/400/440/460V 50/60/60/60Hz EISA 460V 60Hz |
| Exterior | Totally enclosed fan cooled type (inside, outside installation) |
| Protection system | IP44 |
| Electrically-driven power system | Motor with 2-poles over 11kW is dedicated for a direct connection.<br>Motors with 4-poles and 6-poles are for both direct and crossed belt connections. |
| Rotation direction | Counter-clock-wise (CCW) direction viewed from the edge of axis. |
| Compatible standard | JEC-2137-2000 (Efficiency is compatible with IEC 60034-30.) |

| Robot | MELFA　F Series |

### High speed, high precision and high reliability industrial robot

◎Compact body and slim arm design, allowing operating area to be expanded and load capacity increased.

◎The fastest in its class using high performance motors and unique driver control technology.

◎Improved flexibility for robot layout design considerations.

◎Optimal motor control tuning set automatically based on operating position, posture, and load conditions.

Product Specifications

| | |
|---|---|
| Degrees of freedom | Vertical:6　　Horizontal:4 |
| Installation | Vertical:Floor-mount, ceiling mount, wall mount (Range of motion for J1 is limited)<br>Horizontal:Floor-mount |
| Maximum load capacity | Vertical:2-20kg　　Horizontal:3-20kg |
| Maximum reach radius | Vertical:504-1503mm　　Horizontal:350-1,000mm |

| EDM | Wire EDM MV1200R |
|---|---|

### Next-generation Innovations of our best selling Performance Machine.

◎Total running cost reduced up to 42%, which is accounted for 90% by filter, ion exchange resin and power consumption.
◎Improved productivity by an innovative automatic wire threading.
◎Faster machining is realized with improved power-supply performance.
（Rz3. 5µm/Ra0. 45µm with 3cuts）（Rz2. 0µm/Ra0. 28µm with 4cuts）

Product Specifications

| Model | | MV1200R |
|---|---|---|
| Machining travel (X×Y×Z)[mm] | (in) | 400(15.7)×300(11.8)×220(8.7)(XY axis OPT-drive specifications) |
| Machining travel (U×V)[mm] | (in) | ±60(2.4)×±60(2.4)(OPT-drive specifications) |
| Max. taper angle [°] | | 15° (maximum 200mm)(7.9") |
| Max. workpiece dimensions [mm] | (in) | 810(31.9)×700(27.6)×215(8.5) |
| Wire diameter [mm] | (in) | 0.1(.004) to 0.3(.012)※1 |
| Dielectric fluid | | Water |
| Footprint (W×D)[mm] | (in) | 2025(79.7)×2760(108.7) |

※1：Φ0.2(0.08) DD guides and Φ1.5(0.06) jet nozzle are standard equipment.

| Laser Processing Machine | $CO_2$ 2-Dimensional Laser Processing Machine eX-Series |
|---|---|

### A global standard $CO_2$ 2-dimensional laser processing systems.

◎Productivity has been dramatically enhanced owing to improved acceleration and the latest control technologies exclusive to Mitsubishi Electric.

◎2 Action Cutting allows for the entire process, from job setup to parts cutting, to be completed in two simple actions.

◎When not processing, the system switches to ECO mode and the resonator stops idling. Minimizes energy consumption, reducing running costs by up to 99%[1] during standby.

[1]: Compared to the previous LV-Series with Mitsubishi's designated benchmark shape.

Product specifications

| Model Name | ML3015eX |
|---|---|
| Drive system | Flying optic (3-axis beam movement) |
| Stroke (X×Y×X)  [mm] | 3100×1565×150 |
| Rapid feedrate  [m/min] | X,Y axes: Max. 100; Z-axis: Max. 65 |
| Processing feedrate  [m/min] | Max. 50 |
| Positioning accuracy  [mm] | 0.05 / 500 (X,Y axes) |
| Repeat accuracy  [mm] | ± 0.01 (X,Y axes) |
| Rated output  [W] | 4500 |

| Laser Processing Machine for Substrate Drilling | GTW4 Series |
|---|---|

### Ever-evolving global standard machine

◎Newly-developed super-fast galvano and 360W high-power resonator achieve industry-leading productivity.

◎Laser beam generated by unparalleled resonator enables stable high-quality copper-direct processing on various surface treatments.

◎Single machine can support variety of processing application with Mitsubishi unique powerful laser and optimum beam control.

◎Original resonator structure, which can be refreshed by replacing some parts only, realizes low operating cost.

Product specifications

| Model name | ML605GTW4(-H)-5350U／ML605GTW4(-P)-5350U／ML706GTW4-5350U |
|---|---|
| Processing workpiece dimensions (mm) | 620×560／815×662 |
| XY table maximum feedrate (m/min) | 50 |
| Laser type | $CO_2$ laser |
| Oscillator power (W) | 360W |
| Oscillator set pulse frequency | 10 to 10000Hz |

# [ Related Factory Automation Products ]

## CNC | Mitsubishi CNC M700V Series

### High-grade model equipped with advanced complete nano control

◎Achieve complete nano control with the latest RISC-CPU and high-speed optical servo network.

◎Realize super-high grade processing by combining the complete nano control, state-of-the-art SSS control and OMR control, etc.

◎Display of essential information of grouped on three screens to greatly reduce processing setup time with easy operability.

◎The M700VW Series with WindowsXPe and M700VS Series with integrated control unit and display type are available.

Product Specifications

| | |
|---|---|
| Maximum number of control axes (NC axes + spindles + PLC axes) | 16 axes (M720VW/M720VS have 12 axes) |
| Maximum number of part systems | Machining center system: 2 systems  Lathe system: 4 systems |
| Least command increment | 1nm (M720VW/M720VS 0.1μm)) |
| Least control increment | 1nm |
| Maximum program capacity | 2,000kB (5,120m) |
| Maximum PLC program capacity | 128,000 steps |
| Main functions (for machining center) | Simultaneous 5-axis machining, SSS control, high-speed high-accuracy control, tool nose point control, tilt plane machining, etc. |
| Main functions (for lathe) | Milling interpolation, 2-system simultaneous thread cutting, inter-system control axis synchronization, control axis superimposition, combination control, etc. |

## Low Voltage Circuit Breakers | Mitsubishi WS-V Series Molded Case Circuit Breakers, Earth Leakage Circuit Breakers

### Technologies based on long year experience realize more improved performance.

◎The new electronic circuit breakers can display various measurement items.

◎Improvement of breaking performance with new breaking technology "Expanded ISTAC".

◎Compliance with global standard for panel and machine export.

◎Commoditization of internal accessories for shorter delivery time and stock reduction.

Product Specifications.

| | |
|---|---|
| Frame | 32-250A Frame |
| Applicable standard | Applicable to IEC, GB, UL, CSA, JIS and etc. |
| Expansion of UL listed product line-up | New line-up of 480VAC type with high breaking performance for SCCR requirement |
| Commoditization of internal accessories | Reduction of internal accessory types from 3 to 1 |
| Commoditization for AC and DC circuit use | Common use of 32/63A frame in both AC and DC circuit |
| Compact size for easy to use | Thermal adjustable and electronic circuit breakers are same size as 250AF fixed type |
| Measuring Display Unit (MDU) breakers | MDU breakers measure, display and transmit energy date to realize energy management. |

## Magnetic Starter | MS-T Series

### Exceed your expectations.

◎10A frame model is over 16% smaller with a width of just 36mm!!

◎New integrated terminal covers.

◎Reduce your coil inventory by up to 50%.

◎Be certified to the highest international levels while work is ongoing to gain other country.

Product specifications

| | |
|---|---|
| Frame | 10 A to 32 A |
| Applicable standards | Certification to various standards including IEC, JIS, CE, UL, TÜV, CCC. |
| Terminal cover | Standard terminal cover improves safety, simplifies ordering, and reduces inventory, etc. |
| Improved wiring | Wiring and operability are improved with streamlining wiring terminal BC specifications. |
| Operation coil rating | Wide range of operation coil ratings reduces number of coil types from 14 (N Series) to 7 types and simplifies selection. |
| Option units | Diverse lineup includes Auxiliary Contact Block, Operation Coil Surge Absorber Unit, Mechanical Interlock Unit. |

# Global network for comprehensive support of

**Legend:** ● Global FA Center ● FA Center Satellite (China) ● Mechatronics Service Base (China) ● Mitsubishi Sales Offices ■ Production Facility ◆ Development Center

## Ratingen, Germany

Mitsubishi Electric Europe B.V.
German Branch (Germany FA Center)

## Kraków, Poland

Mitsubishi Electric Europe B.V.
Polish Branch
(Europe FA Center)

## Hatfield, UK

Mitsubishi Electric Europe B.V.
UK Branch (UK FA Center)

## Praha, Czech Republic

Mitsubishi Electric Europe B.V.
Czech Branch
(Czech Republic FA Center)

## Pune, Gurgaon, Bangalore, Chennai, Ahmedabad, India

Mitsubishi Electric India Pvt. Ltd.

## Bangkok, Thailand

Mitsubishi Electric Factory Automation
(Thailand) Co., Ltd. (Thai FA Center)

## Singapore

Mitsubishi Electric
Asia Pte, Ltd. (ASEAN FA Center)

Nagoya, Japan

## China (including Hong Kong District)

### Beijing

Mitsubishi Automation (China) Ltd.
Beijing Office (Beijing FA Center)

### Tianjin

Mitsubishi Automation (China) Ltd.
Tianjin Office (Tianjin FA Center)

### Guangzhou

Mitsubishi Electric Automation
(China) Ltd. Guangzhou
Office (Guangzhou FA Center)

### Shanghai

Mitsubishi Automation (China) Ltd.
(Shanghai FA Center)

### Shanghai

Mitsubishi Electric Automation
Solution Center

**China map labels:** Changchun, Shenyang, Dalian, Beijing, Tianjin, Zhengzhou, Qingdao, Chengdu, Xiangfan, Shanghai, Chongqing, Wuhang, Fuzhou, Taipei, Guangzhou, Taichung, Shenzhen

# customers' manufacturing.

### St.Petersburg, Russia

Mitsubishi Electric Europe B.V.
Representative Office in St. Petersburg
（Russia FA Center）

### Istanbul, Turkey

Mitsubishi Electric Turkey
A.Ş Ümraniye Branch (Turkey FA Center)

### Seoul, Korea

Mitsubishi Electric Automation
Korea Co., Ltd. (Korea FA Center)

### Taipei, Taichung, Taiwan

L : Setsuyo Enterprise Co., Ltd.

R : Mitsubishi Electric Taiwan Co.,Ltd.

### Chicago IL, USA

Mitsubishi Electric Automation, Inc.
(North America FA Center)

### Hanoi, Ho Chi Minh, Vietnam

L : Mitsubishi Electric Vietnam Co., Ltd.
Hanoi Branch
R : Mitsubishi Electric Vietnam Co., Ltd.

### Tlalnepantla De Baz, Mexico

Mitsubishi Electric
Automation, Inc. Mexico Branch
(Mexico FA Center)

### Jakarta, Indonesia

PT. Mitsubishi Electric
Indonesia Cikarang Office
（Indonesia FA Center）

### Sao Paulo SP, Brazil

L : Mitsubishi Electric do Brasil Comércio e
Serviços Ltda.
R : MELCO CNC do Brasil Comércio e
Serviços S.A

Service bases are established around the world to globally provide the same services as in Japan.

## Overseas bases are opened one after another to support business expansion of our customers.

■ Overseas bases | As of July 2014  * Some includes distributors

| Area | Our overseas offices | FA Center (Satellite) | Bases providing our products | Countries (Regions) |
|---|---|---|---|---|
| EMEA | 11 | 6 (2) | 146 | 54 |
| China | 13 | 4 (10) | 171 | 1 |
| Asia | 21 | 13 | 79 | 10 |
| America | 14 | 4 (0) | 130 | 16 |
| Others | 1 | 0 | 3 | 2 |
| Total | 60 | 27 (12) | 529 | 83 |

## ⚠ Safety Warning

To ensure proper use of the products listed in this catalog, please be sure to read the instruction manual prior to use.

ISO
14001
JACO
ORGANIZATION FOR ENVIRONMENT AND QUALITY・JAPAN AUDIT AND CERTIFICATION
EC97J1113

UKAS
MANAGEMENT
SYSTEMS
051

ISO 9001
BUREAU VERITAS
Certification

BUREAU VERITAS
1828

UKAS
MANAGEMENT
SYSTEMS
008

# MITSUBISHI ELECTRIC CORPORATION

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